

X.16 COMMENT LETTER, U. S. Nuclear Regulatory Commission,
Washington D. C. 20555

X.16.1 Comment

"Idaho Chemical Processing Plant (page II-70); (page II-122), first set of four bins used to store some 7,400 ft³ of calcined high levels cannot be emptied without significant modifications."

Response

This is correct, recognizing that the modifications required are expected to be only those of access parts and vacuum lines and nozzles. The first set of calcined solids storage bins is the only set for which retrievability was not designed. A project is underway to define the design requirements for retrieving calcined solids from this set of bins.

X.16.2 Comment

"Environmental Monitoring Program (page II-332). In addition to the maps indicating monitor locations, a tabulated summary listing medium sampled, type of analysis performed, lower limit of detection, frequency of analysis, sample collection frequency, and sample location is needed to define the complete existing program."

Response

Text changes were made and tables included in Section II.C.12.

X.16.3 Comment

"Radiologically Contaminated Airborne Waste Discharge to the Atmosphere, (pages III-7 and III-10) Table III-II, do not identify the release of carbon-14 radioactivity. What is the estimated or measured C-14 activity released as airborne waste during 1974?"

The impact due to resuspension of surface contamination and movement to other onsite areas or the nearest site boundary locations is not identified in the discussion of soil sampling, radiation monitoring or dose evaluation."

Response

In the past, carbon-14 releases have not been routinely monitored or estimated for INEL facilities. However, see response to similar comment in Section X.17.

Resuspension is constantly monitored by a network of continuous air samplers. The routine soil sampling program at the INEL site also monitors the deposition and movement of surface contamination in the environment. A discussion on resuspension of alpha contamination at RWMC and postulated exposure to this resuspension is given in Section III.B.5. The concentrations of resuspended radioactive particulates that have been released from INEL stacks can conservatively be estimated to be one-third the release values. Using this conservative estimate, the maximum annual whole body offsite dose from the source would be approximately 0.07 mrem.

X.16.4 Comment

"The noble gas doses should include the individual skin dose as well as the total body dose. The direction and distance to the site boundary location in Table III-III should be given."

Response

The skin doses from the noble gases are included in Table I-2 in Section I of final statement. Appendix D presents concentration isopleths as a function of distance and direction from the major INEL facilities.

X.16 COMMENT LETTER (Continued)

X.16.5 Comment

"Table III-III should be revised or separated to provide a summary of doses by pathways as shown in Figures III-1 through III-3 for the maximum individual and the population. The maximum individual doses should include total body and organ doses, for each type of effluent release at the nearest locations of concern with applicable pathways identified. The population summary should include doses attributed to noble gas submersion, inhalation, ground deposition, terrestrial foods, drinking water and recreation for all types of effluents released. The population table should also include occupational doses applicable to waste management operations. These tabulations would provide a summary of the doses discussed in Section III.B and now being used in current environmental statements."

Response

A summary table (Table I-2), showing dose estimates by isotope and environmental pathway, is included in Section I of the final statement.

X.16.6 Comment

"Milk pathway doses for the nuclides, I-129, I-131, Sr-90, and Cs-137, are not identified with a specific location. Therefore, it is not clear whether these doses are applicable to an individual at the same location or at different locations."

Response

Milk from ten locations around the INEL site is routinely monitored for radionuclides. The complex processing and distribution network for milk hinders determination of the exact location of a person consuming the milk products. In most cases, the impact of INEL site operations was not measurable above the detection limits, and the doses calculated on the referenced pages are maximum possible values.

X.16.7 Comment

"The dose commitment due to consumption of vegetables from farm gardens or residence gardens adjacent to the site is not discussed or estimated. Inhalation doses for nuclides other than tritium, I-129, I-131, Sr-90 and noble gases appear to be omitted from consideration. If domestic meat or milk animals other than sheep graze on INEL vegetation, how are potential doses addressed?"

Response

Principal farm crops in areas surrounding the INEL site are wheat, potatoes, and sugar beets. Wheat and potatoes (starting in 1976) are monitored. No residential gardens are monitored. Calculations indicate that an individual consuming all of the radioactivity dry-deposited on grass for 3 months at the 1974 maximum offsite air concentrations would receive about 1 mrem. Leafy vegetable, properly washed, would result in a much lower dose. Furthermore, no gardens are known to exist in the area of maximum offsite air concentrations.

Inhalation doses for nuclides other than H-3, I-131, Sr-90, and noble gases are included in Table III-3 of the final statement.

Since 1975, meat is analyzed for Cs-137 from steers that grazed onsite and from steers that grazed distant from INEL. No milk animals graze onsite, although if they did, their milk would become part of the routine milk monitoring program.

X.16 COMMENT LETTER (Continued)

X.16.8 Comment

"How was the annual natural background direct radiation dose of 150 +15 mrem determined? The Environmental Protection Agency report (ORP/SID 72-1) on natural radiation exposure shows 124 mrem/yr (including 18 mrem/yr internal exposure) for Idaho and a total background dose rate of 180 mrem/yr is given in the INEL (1974) monitoring report."

Response

The 150 +15 mrem annual background direct radiation dose is the predicted whole body dose in the vicinity of the INEL site. The value was calculated from actual measurements of the terrestrial and ionizing cosmic radiation dose with TLD dosimeters, and estimates of the doses from cosmic radiation (neutron component) and internal emitters. The 180 mrem annual whole body background dose reported in the 1974 Environmental Monitoring Program Report was derived entirely from estimates of the terrestrial, cosmic, and internal doses. The estimate of the terrestrial component was in error, and was revised downward in the 1975 report. The value reported by the Environmental Protection Agency (ORP/SID 72-1) is the average annual gonadal dose (124 mrem) for Idaho, which reflects dose reductions from structural and biological shielding. This correction is made in Section III.C.13.

X.16.9 Comment

"The radioactive liquid discharges for OMRE, SL-1 or ARA are not listed in Table III-SVII and the range of activity was not identified in the discussion. The method of restricting and monitoring resuspension of radioactivity from retired and other ponds, when in a dry condition, is not clear."

Response

Very few data are available from early releases to the ground from these facilities. The reactors involved were all closed liquid system reactors and did not discharge coolant or moderator liquids to the leaching ponds, but rather to holding tanks contents of which were subsequently transferred to ICPP. The water discharged to the leaching ponds was usually wash water with radionuclide concentrations well below protection guides for uncontrolled areas.

In regard to resuspension from retired ponds, SL-1 had no pond, the ARA pond is still in use for nonradioactive liquid waste discharge and the OMRE pond is retired. The two open ponds present no identifiable problems. Resuspension is monitored by soil sampling near ponds. If further studies indicate a need, appropriate action will be taken.

X.16.10 Comment

"It is not clear what assessment is made or needed for offsite river pathway doses (fish-recreation). Figure 1s III-29 and -31 should be produced annually (tritium in ground water)."

Response

All rivers crossing the INEL site boundary drain onto the site, from whence they disappear into sinks. There are no known recreational uses of the rivers once they enter site boundaries. Although fish in the Big Lost River are known to move upstream, none of the fish analyzed for radioactivity have shown concentrations other than background.

Tritium data in groundwater are collected annually. New maps are published in current reports as appropriate.

X.16 COMMENT LETTER (Continued)

X.16.11 Comment

"The monitoring used to evaluate the extent of radionuclide migration from the SL-1 burial site and the ANL high-level waste storage area is not clear."

Response

A table summarizing the environmental monitoring at the SL-1 burial site and the Radioactive Waste Management Complex has been included in Section II.C.12. Section II.A.9 describes the monitoring at the ANL storage facility.

X.16.12 Comment

"The occupational doses pertaining to solid waste operations are not given or referenced."

Response

See response to Comment X.2.1.

X.16.13 Comment

"The referenced (C-9) NRC Regulatory Guide 1.42 is outdated. Regulatory Guide 1.109 (RG 1.109) is now used for providing guidance on procedures and models for estimating radiation doses to man from radionuclide effluent releases. R.G. 1.109 was developed by the NRC staff as one of a series of guides to implement Appendix I to 10 CFR, Part 50.

R.G. 1.109 contains a description of pathways and models used for calculating radiation doses. NRC Regulatory Guide 1.111 describes methods for estimating atmospheric transport and dispersion of gaseous effluents associated with routine releases from light-water-cooled reactors."

Response

The calculational methods used in this statement to determine radiological doses from airborne effluents were compared with the newer Regulatory Guides 1.109 and 1.111. The two calculational methods are comparable and both relate to D. H. Slades work in 'Meteorology and Atomic Energy - TID-24190.' The radiological doses from the atmospheric transport of airborne radionuclides presented in this statement are conservative evaluations.

X.17 COMMENT LETTER, Environmental Protection Agency
Washington, D. C. 20460

X.17.1 Comment

"The analysis of the risk for transportation accidents is limited to those involving radioactive materials generated by INEL facilities and remaining within the site boundaries. The final statement should include a risk evaluation for all radioactive shipments entering the INEL since an environmental impact should include doses received during transportation of radioactive materials.

Accidents involving transuranic waste or high-level radioactivity in fuel element form have not been addressed sufficiently. Also, the presentation of transportation statistics for the INEL site could aid in the assessment of the environmental impact created by the transportation of radioactive materials nationally."

X.17 COMMENT LETTER (Continued)

Response

Waste shipped to INEL from other ERDA facilities adheres to appropriate DOT regulations. The risk analysis of these shipments of waste were not considered within the scope of this statement. Risk analysis of the transportation of radioactive material has been the subject of a number of studies. Reports containing the risk evaluation include:

- a. Final environmental statement, The Transportation of Radioactive Material by Air and Other Modes, NUREG-0170, Docket No. PR-71, 73 (40 FR 23768) 1977, Office of Standards Development, U.S. Nuclear Regulatory Commission.
- b. An Assessment of the Risk of Transporting Plutonium Oxide and Liquid Plutonium Nitrate by Truck, BNWL-1846 (August 1975).
- c. An Assessment of the Risk of Transporting Plutonium Dioxide and Liquid Plutonium Nitrate by Train, BNWL-1996 (February 1977).
- d. Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants, U. S. Atomic Energy Commission, Directorate of Regulatory Standards, WASH-1238 (December 1972).
- e. Transportation Accident Risks in the Nuclear Power Industry - 1975 - 2020, prepared for the U. S. Environmental Protection Agency, NSS-8191.1 (November 1974).

Reference a. concludes that: "the radiological risk from accidents in transportation is small, amounting to about one-thousandth of the normal transportation risk on an annual basis. The average radiation exposure of the population at risk from normal transportation is a very small fraction of the limits recommended for members of the general public from all sources of radiation other than natural and medical sources, and is a small fraction of natural background radiation."

Irradiated fuel elements are transported to INEL from other locations outside of Idaho. Intra-INEL shipments are also made. Technically, these are not considered to be waste shipments. Nevertheless, irradiated fuel shipments risk analysis has been performed and reported in Reference a., above. Accidental releases from irradiated fuel elements were modeled and evaluated in References d. and e.

A significant risk in the transport of high-level radioactive wastes has been identified in the document, "Environmental Survey of the Uranium Fuel Cycle," U. S. Atomic Energy Commission, Fuels and Material, Directorate of Licensing, WASH-1248, April 1974. There have never been shipments of high-level radioactive waste, either intra or inter, at INEL and none are anticipated until after 1985.

The experience gained at INEL from the transportation of radioactive waste (and other materials) has been included in the national assessment of this problem.

X.17.2 Comment

"On pages III-138 and 139 the draft statement indicates that the curie content of a release from a transport vehicle accident involving a fire is small compared to the routine release of particulates from stacks at INEL plants. This is too general a treatment of accident consequences and the final statement should be more specific. The environmental radiation dose impact and health effects of 0.31 curies of Pu-239 may differ considerably from 0.31 curies of Mn-54."

X.17 COMMENT LETTER (Continued)

Response

Text changes made in Section III.C.7.

X.17.3 Comment

"The statement notes that INEL receives plutonium wastes from the ERDA Rocky Flats plant. These wastes are then stored in containers designed for 20 year integrity requirements. This short-term storage could be accomplished at the generation site. The final statement should, therefore address the question of why these wastes are transported to INEL and identify the trade-offs involved between increasing the dose commitment at Rocky Flats and reducing the risk of a transportation accident caused by release of plutonium."

Response

Transuranium contaminated wastes are received for interim storage at INEL from four other ERDA facilities; Rocky Flats near Denver, Colorado; Argonne National Laboratory near Chicago, Illinois; Mound Laboratory near Dayton, Ohio; and Bettis Atomic Power Laboratory near Pittsburgh, Pennsylvania. ERDA has assessed the interim storage at the individual generation sites versus a "centralized" interim storage facility. Considering such factors as storage needs, safeguards, and transportation, ERDA has determined that cost risk benefit substantiates its policy of minimizing the number of storage sites.

X.17.4 Comment

"The individual and population dose equivalents in the draft statement for INEL radioactive waste discharges have been presented for a specific facility, for a particular radionuclide in a single, presumably critical pathway, or at a particular geographical location. A consolidation of dose estimate and projections in a single summary section would be helpful. For instance, a summary chart or table could present INEL boundary (fenceline) individual organ and whole body doses related specifically to radionuclide and onsite sources of airborne radionuclides."

Response

A summary table showing dose estimates by isotope and environmental pathway is included in Table I-2, Section I.

X.17.5 Comment

"The statement calculates and projects the maximum health effects on the earth's population from the INEL waste management operation utilizing the BEIR report in its unmodified form, the most reasonable model to use to calculate health effects at this time, in our opinion. However, total whole body doses and organ doses should be calculated as realistically as possible for those individuals now living nearest the site. The calculation should be repeated for hypothetical situations where individuals could reasonably expect to reside in the future and where the projected dose may be higher."

Response

The requested information is presented in various parts of Section III of the final statement. In addition, a summary table showing doses from all environmental pathways has been included in Section I (Table I-2).

X.17.6 Comment

"A significant exposure pathway appears to be through contaminated ducks. It is interesting to note that the eating of one pound of contaminated duck could result in a 25 mrem whole

X.17 COMMENT LETTER (Continued)

X.17.6 Comment (Continued)

body dose and a 20 mrem thyroid dose. Admittedly, few people would be exposed to such a dose. However, we believe the final statement should discuss the means available to keep the ducks away from the seepage ponds or to reduce the radionuclide concentration in the effluent to these ponds."

Response

The draft statement describes the aspects of the INEL waste management program as they existed December 30, 1974. From that time to the present, while there have been no barriers erected to prohibit ducks from landing on the seepage ponds, a conceptual design has been drawn up and initial phases are currently being implemented to recycle waste water at TRA. This program has as two of its objectives:

- a. Gradual reduction of presently discharged waste volumes through segregating and recycling appropriate streams
- b. Treatment of liquid waste at a point as near its source as possible to avoid the necessity of handling larger volumes of waste and discharging larger volumes of water.

When the program is fully implemented and in operation, it will completely eliminate the liquid effluent now discharged to the radioactive seepage ponds, the ponds will shrink in size, then disappear, and will not attract ducks as in the past. A program is being developed, in conjunction with the recycle project, to ensure the safe containment of residual radioactivity after the ponds dry up. The TRA water recycle program is discussed in Appendix E of the final statement.

X.17.7 Comment

"The final statement should discuss the radionuclide sources contributing to the evaluated gamma radiation levels beyond the fenced areas of test facilities at INEL (page III-25). The discussion should indicate what the different effluent control and environmental monitoring systems are, depending on the type of release and whether such levels are from discrete short duration discharges or as a long-term environmental buildup of leakage of airborne or waterborne radioactivity."

Response

As the text indicates, the exposure rates shown in Figures III-7 through III-22 are not the result of surface contamination alone, but include contributions from direct radiation from materials inside facility boundaries, such as stored fuel, contaminated pond water, contaminated equipment, and from airborne effluents. In most instances, the direct radiation is from sources within the facility boundary. This is evident from the symmetrical distribution of the exposure rate around a facility or a leaching pond. In Figure III-9, some of the exposure rate can be attributed to ground contamination from fallout of airborne effluents because the distribution shows the effect of the prevailing winds in the area. This contamination is probably the result of long-term buildup resulting from ICPP stack releases. ICPP has now installed an Atmospheric Protection System, discussed in Section II.A.3.a., which markedly reduces particulate releases and limits future long-term buildup in the environment from this source.

X.17.8 Comment

"On page III-32, the resuspension of plutonium in soil within a few kilometers of the INEL (ICPP) operating areas may result in an exposure pathway significant for grazing animals

X.17 COMMENT LETTER (Continued)

X.17.8 Comment (Continued)

or humans present only during periods of low airborne plutonium concentrations. Though probably not a major or primary pathway, the resuspension pulmonary dose should be estimated. Similarly, the plutonium resuspension situation at the site boundary should be discussed in the final statement."

Response

A discussion on the impact of particulate activity, including plutonium, is included in Section III.B.1. As the text indicates, the maximum annual dose to the pulmonary region of the lung from measured air concentrations at the INEL boundary is 1 mrem. In Section III.B.5, resuspension of surficial plutonium is considered as originating from the area near the RWMC. As shown in Figure III-26, very low levels of plutonium also occur around the RWMC in about the same concentrations as near ICPP. Dose evaluations are presented for plutonium resuspension at CFA and for a member of the public who makes a brief stopover at the rest station at the Big Lost River Bridge on U. S. Highway 20-26. Doses of 0.05 mrem and 0.002 mrem, respectively, are presented.

X.17.9 Comment

"The limit for I-129 is 5 millicuries/gigawatt-year. This limit, though not directly applicable to INEL operations, can be compared to the ICPP average annual release rate of 100 millicuries and the maximum value of 7,000 millicuries given by the draft statement. These releases would be the same as the potential releases to the environment from the fuel of twenty to fourteen-hundred 1,000 MW nuclear LWR's. The final statement should discuss these comparisons and indicate what ERDA is doing to reduce these release quantities."

Response

Calculations based on the total amount of fuel processed, approximate fuel burnups, and production rates of iodine show that about 3 Ci (the statement conservatively estimates 7 Ci) of I-129 would be the maximum amount present in all the fuel processed at ICPP from 1953 through mid-1976. Not all of this I-129 has been released, however, since somewhat more than one-fourth of all high-level liquid waste produced is still in storage awaiting calcination. The calculated I-129 release rate is much higher than EPA's proposed limit of 5 millicuries/gigawatt year; therefore, if this limit were to be applied to ICPP, iodine removal systems for both the dissolution and calcination processes would be considered. Technology for iodine trapping is currently under development and could be applied if necessary.

X.17.10 Comment

"On pages III-44-45, it is stated that an adult would receive a yearly dose of 21 millirem from I-129 to the thyroid if he consumed 80 kilograms of meat per year obtained from animals slaughtered after grazing in areas of highest contamination. The final statement should include some discussion of the numbers of individuals receiving such a dose."

Response

The iodine-129 dose evaluation presented in the statement is a theoretical evaluation. As indicated, environmental iodine-129 measurements are not presently adequate to quantify the impact on man. The calculations, therefore, use conservative assumptions to estimate the maximum dose that might be received. No one would be expected to receive such a dose. It would be highly speculative to estimate the number of individuals who might receive a significant fractional part of the maximum calculated 21 mrem. It could be assumed that less than 100 people might receive a few mrem from this source.

X.17 COMMENT LETTER (Continued)

X.17.11 Comment

"The projected dose equivalent to members of the general population should preferably be in units of mrem/year; i.e., as in current generic environmental standards, and as radiation 'dose equivalent' as defined by the International Commission on Radiological Units and Measurements. The impact for INEL 1974 operations is given in the draft statement as 2.0 man-rem. Although the pathways considered are discussed, there is no explicit presentation of the population dose by nuclide released and by pathway. Nor are there concise presentations of the dose to the 'maximum' individual, or of population organ doses. Table III-III on page III-41 is not complete. Tables III 1-15g and III, 1-141 of ERDA-1538, (Waste Management Operations, Hanford Reservation, Final Environmental Statement, December 1975), are good examples of such summary tables. On page III-120, Table III-XXV, the population dose is given as 7.7 man-rem, while on page III-121, and throughout the document this value is listed as 2.0 man-rem. The final statement should resolve these discrepancies. Table III-XXV also shows organ-rem doses of 8.5 and 43 man-rem to the lung and thyroid, respectively. These values further point up the need for INEL to use tabulated data to summarize the impacts."

Response

A summary table (Table I-2) showing dose estimates by isotope and environmental exposure pathway is included in Section I of the final statement.

With respect to the noted "discrepancy" between the 7.7 man-rem value and the 2.0 man-rem value, the following explanation is given: the 2.0 man-rem number was calculated assuming direct exposure to INEL airborne effluents; the 7.7 man-rem value follows from the indirect exposure to individuals who consume 80 kg (176 lb) of meat from animals in equilibrium with the I-129 levels in their local environment. This difference is identified in the final statement.

X.17.12 Comment

"On page IV-1, the release of krypton-85 into the atmosphere from INEL operations is reported at 253,900 curies for 1974. EPA has proposed a Kr-85 limit of 50,000 curies per gigawatt-year for the normal operations of the uranium fuel cycle to be effective in 1983. By 1983, the U. S. commercial fuel reprocessing capacity is expected to be able to handle the equivalent of about 40 gigawatts of nuclear power plant capacity per year. Thus, the commercial reprocessing industry would be limited to 2,000,000 Ci/year of Kr-85. In actual practice, the release would be expected to be substantially smaller, perhaps 200,000 Ci/year. At current levels, the INEL environmental release of this radioisotope would, in comparison, be significant. The final statement should address control of Kr-85 releases by INEL. In addition, because carbon-14 releases are generally anticipated to be more significant than Kr-85, a full treatment of C-14, including its worldwide dose commitment and alternatives for control, should be presented in the final statement."

Response

Release rates for krypton-85 are above the limit proposed by EPA but far below the ERDAM 0524 RCG. If the proposed EPA limits were applied to ICPP it would be necessary to install a high efficiency rare gas removal system. A system is presently in use for intermittent partial recovery of krypton-85 from one effluent stream, but this system is not designed for environmental protection and would require substantial modification and expansion of capacity to trap high percentages of all the Kr-85 currently released during fuel reprocessing. The only alternative to atmospheric dispersion of krypton-85 is collection and storage. This alternative is discussed in Section V of the final statement.

C-14 release rates have not been routinely monitored at ICPP. A sampler-monitor system, however, has been developed and is expected to be in operation in 1977. If C-14 levels above

X.17 COMMENT LETTER (Continued)

Response (Continued)

natural background are observed, environmental impacts will be assessed, and if appropriate, control measures considered.

X.17.13 Comment

"An 18-year record of the airborne waste volumes and total radioactivity released through the ICPP stack is presented in Section III of the statement. Recognizing that earlier data will not permit a breakdown of individual radionuclide data by source within the facility, EPA believes the final statement should include a more explicit presentation of individual contributing air flows and the radionuclide composition which would permit a better understanding of possible peak values in the ICPP stack effluent concentrations. Some discussion of the current techniques for calculating the annual average stack discharge values would be helpful for the final statement."

Response

Because the impact of radionuclide release on the environment is a function of the total amount released from ICPP, inclusion in the final statement of air flows and radionuclide composition of individual streams is not appropriate. The ICPP stack monitor provides a continuous record of effluent release rates and peak values of stack effluent concentrations. The stack effluent is sampled isokinetically at the 90 ft level (the stack is 250 ft high). A 10 ft³/min sample is routed from the 90 ft level to instrumentation at ground level. Part of the sample (8 ft³/min) is directed through a HEPA filter. This filter is removed every 24 hours and undergoes chemical analyses for identifications of collected radionuclides. The remaining sample (2 ft³/min) is routed through a sodium iodide detector which provides continuous monitoring and also alarms at higher than normal concentrations. The data from the stack monitoring system are available in the INEL Radioactive Waste Management Information Report. The data source is Reference 8 in the final statement.

X.17.14 Comment

"Page II-25, Table II-1 indicates a considerable range of annual radioactive airborne discharges at ANL. Though not indicated in the draft statement, would not remote indication of individual facility radiation unit alarms at a central INEL location provide warnings of airborne or waterborne releases? This might permit more effective institution of protective actions such as evacuation of people or diversion of high-level waste streams from environmentally sensitive pathways. Additional information in the final statement on possible use of such direct warning instrumentation would be helpful."

Response

Protective actions (such as possible evacuations of people) can rationally be based only on good information of the following kinds: (a) the quantities (Ci) of radioactivity released (b) the distribution of total radioactivity between radioisotopes of different half-lives (c) wind data. The best place to acquire the information of (a) and (b) is at the point of release; but information on item (c) may require data from several points when an area is large as INEL and its surrounding territory must be considered. For example, at the TAN facility located at the north end of INEL, the wind direction is often exactly opposite from that at the RWMC located at the south end of INEL. The point is that additional information is needed over and above the particulars of the release itself. An emergency action plan in force at INEL requires cognizant officials at the various facilities to immediately alert ERDA when abnormal releases occur. Depending on the magnitude and the half-lives of the released material and on wind information, ERDA-ID would put into effect the appropriate emergency protective actions which have all been carefully planned in advance. An elaborate

X.17 COMMENT LETTER (Continued)

Response (Continued)

on and offsite communications system provides fast transmittal of all information. Plans for emergency action have been drawnup, not only for the INEL site itself, but also for the adjacent counties.

In addition to the preceding system of warnings of airborne radioactive releases (and follow up with appropriate protective actions if needed) the Health Services Laboratory of ERDA-ID maintains a monitoring system of radiation detectors located at some 20 different points, both on and offsite. The individual stations each have GM detectors continuously operating, and their readings are constantly telemetered to a central station at the laboratory. If an airborne release occurred, it is possible to remotely activate constant air monitors located at each station. The assistance of the NOAA office at INEL is also available at any time in determining what emergency protective actions may be needed.

Waterborne releases at INEL are much less of a potential problem than airborne releases since there are no streams flowing out of INEL and all facilities are located at some distance from the Big Lost River which enters the site but sinks into the ground on the site itself. Facilities for holdup and analysis of radioactive wastes, which may be released to the environment, ensure that only acceptable releases occur.

X.17.15 Comment

"On page III-5, the discussion of flooding should be expanded to consider the interaction of buried radioactive waste with repetitive inundation. Although the draft statement does later address this subject on page III-106, stating that contaminants have moved only a short distance (that is, a few inches past the interface between the soil and the wastes) after flooding conditions, repetitious flooding and various burial procedures should be considered. In addition, some estimate should be made of the degree of retention of radionuclides by the various physical barriers as well as the extent of migration into soil domain and/or groundwater in the extreme flooding conditions."

Response

Section III.B.5 of the statement relates the possibilities of leaching of radioactivity and movement toward the aquifer, and notes that current practices of grading and drainage at RWMC reduce percolation. The effects of repetitive inundation and flooding, therefore, are very likely not going to be localized on the burial area but will be draining adjacent to the area.

The data summarized and referenced in this section (Section III.B.5) is to an extent the result of repetitive flooding conditions and the contaminant absorption was noted in the sand and clay interfaces above the basalts, indicating only inches of movement. From the data, it appears that the clays are serving as barriers to significant migration, as suggested by the mathematical models referenced. In 1976 clay materials, immediately beneath wastes buried in 1963, were sampled and examined for waste nuclides which might have leached out of the buried waste and migrated downward into clay with percolating water. The results showed that significant waste migration had proceeded in a downward direction only to the extent of a few inches confirming earlier findings and model predictions. The dike system constructed around the perimeter of RWMC serves to prevent flooding of the kind that occurred in 1962 and 1969, and therefore provides added protection of buried wastes. Numerous repeated floodings and greatly increased soil permeability would be required to transport radionuclides buried near the surface to the underlying aquifer.

X.17 COMMENT LETTER (Continued)

X.17.16 Comment

"On page III-13 and page II-333, the planned soil sampling survey should provide additional information on the long-term environmental impact of INEL operations. The development of soil radioactivity profiles in terms of specific radionuclide content with depth would illustrate the environmental impact of INEL operation in comparison with weapons fallout, providing such data are available. Soil profile sampling could utilize existing locations of a sampling grid determined from meteorological records and operational information on release quantities."

Response

Radionuclide migration downward in soil in Southeastern Idaho is very slow, due to the small amount of precipitation received. Soil profile studies are not sufficiently sensitive to distinguish depositions due to INEL site operations and from depositions due to weapons testing. Distinction is made on a basis of statistical difference between onsite and offsite locations.

X.17.17 Comment

"Insofar as some of the burial sites receive snowmelt runoff and there is little geologic data for some of the older burial grounds, it would be helpful if a list of the studies of radionuclide migration which have been made for all of the burial grounds (active and inactive) at INEL would be presented in the final statement."

Response

The studies that have been completed as of December 31, 1974, were summarized or referenced in the draft statement. The suggested list of studies would be composed of the following references noted in Appendix A: 61, 62, 63, 70, 76, 104, 105, 106, and 110. Only two burial sites at INEL have been utilized, RWMC and the SL-1 Burial Ground.

Additional studies of radionuclide migration that have been published since December 31, 1974, include the following:

J. L. Harness et al, Onsite Environmental Surveillance Report for the INEL Radioactive Waste Management Complex, Annual Report-1974, TREE-1014 (December 1976).

J. T. Barracclough; J. B. Robertson, V. J. Janzer, Hydrology of the Solid Waste Burial Ground as Related to the Potential Migration of Radionuclides, Idaho National Engineering Laboratory, IDO-22056 (August 1976).

W. H. Burgus and S. E. Maestas, The 1975 RWMC Core Drilling Program, IDO-10065 (July 1976).

These documents are summarized and referenced in Section III.B.5.

Further subsurface sampling (core drilling) and analysis programs were carried out during 1976 and are continuing in 1977; final reports, however, have not yet been published.

X.17.18 Comment

"Independent studies at INEL burial sites showed that plutonium contamination moved downward beneath land disposal areas. Breakthrough of Sr-90 in soils below seepage pits has also been experienced. The final statement should specifically explain such migrations/breakthroughs in terms of occurrences, locations, potential for repetition elsewhere. More information is needed on the underlying data base and knowledge supporting such operations, and the nature

X.17 COMMENT LETTER (Continued)

X.17.18 Comment (Continued)

of monitoring programs in the unsaturated zone. Movement of radionuclides from any of the burial grounds is a major concern of the EPA and should be thoroughly addressed, particularly considering that most of the wastes at RWMC to date are nonretrievable (Table II-LV)."

Response

The statement provides the data base and knowledge of measurable occurrences of radionuclides, in particular tritium, from the TRA seepage pond. The available data, as of December 31, 1974, on migration of plutonium in INEL soils were provided in the draft statement. However, two studies on this subject have recently been completed. The following two documents are summarized and referenced in Section III.B.5. of the final statement:

J. T. Barraclough, J. B. Robertson, V. J. Janzer, Hydrology of the Solid Waste Burial Ground as Related to the Potential Migration of Radionuclides, Idaho National Engineering Laboratory, IDO-22056 (August 1976).

W. H. Burgus and S. E. Maestas, The 1975 RWMC Core Drilling Program, IDO-10065 (July 1976).

See also the response to previous comment.

X.17.19 Comment

"Page II-220: The RWMC monitoring well network of five wells, twenty-seven shallow probes, one surface water station, and moisture sampling pipes does not seem adequate to monitor a burial facility of this scale and containing the quantity of long-lived radionuclides stored (93,525 Ci) or disposed (5,978,000 Ci). Presumably, more sophisticated monitoring programs are available or exist and these should be described, along with a summarization of sampling results."

Response

Additional data on the INEL environmental monitoring program, including the RWMC monitoring program, are presented in Section II.C.12 of the final statement. In addition, Appendix E includes summary statements and references to ecology studies presently in progress at RWMC. Additional wells were drilled at RWMC in 1975, 1976, and 1977 and provide additional monitoring capability. Plans have also been made for unsaturated flow monitoring at RWMC.

X.17.20 Comment

"Page II-214 to page II-222: The distinctions between the TSA, TDA, SDA, trenches, pits, and asphalt pads, all of which are part of the RWMC, are not particularly clear. Perhaps a simplified map and a table to identify the location, contained waste volume/activities, monitoring systems, etc., can be included in the final statement to show the association of these facilities to each other within the RWMC and in relation to other solid waste facilities and INEL. The monitoring network for all facilities and the results of such monitoring to date should be described."

Response

An updated and more clear aerial view of RWMC is included in the final statement with major features (TSA, TDA, SDA) identified. Additional text is also provided giving detail to SDA, TDA, and TSA and the use of these facilities for either storage or disposal of wastes.

X.17 COMMENT LETTER (Continued)

Response (Continued)

Additional data on the RWMC environmental monitoring program is presented in Section II.C.12 of the final statement.

The results of the monitoring program are contained throughout Section III.

X.17.21 Comment

"Investigations of radionuclide migration in the RWMC have been completed and the results are summarized. What continuing program of monitoring is underway? With respect to flooding from snowmelt and rainfall in 1962 and 1969, were such incidents anticipated in site selection and operation? How are siting criteria for waste disposal developed at INEL? What is the significance of such flooding events at seven-year intervals on the long-term performance of all burial sites and soil-retained radionuclides beneath seepage pits?"

Response

The current monitoring program includes annual gamma ray surveys, soil sampling, air sampling and surface and subsurface water sampling of rainfall and snowmelt. These programs are summarized in Section II.C.12. Also an extensive core drilling program is in progress, supplementing similar programs at RWMC carried out in 1971 and 1972 and in 1975. Plans have also been made to study unsaturated flow at RWMC.

The two flooding events noted in 1962 and 1969 were unexpected, in the sense that no provision was made to preclude water from entering RWMC. They are considered random occurring natural events. As noted, to preclude the increased percolation resulting from flooding, an improved drainage and grading system has since been installed at RWMC. Some experts (Barracough - USGS) feel that repeated flooding of this type would constitute a possible driving mechanism to carry small amounts of contaminants toward the aquifer. Since this possibility is not precluded, the elimination of this potential driving force is considered prudent.

X.17.22 Comment

"Page II-230 to page II-233: The ANL radioactive sScrap and waste facility reportedly contains about 10 million Ci of activity emplaced in a 10-year period, i.e., and average of 1 million Ci/year. Is 1974 a typical year as far as radionuclide distribution considering that only 91,536 Ci were emplaced? If the amount of activity is only 20 percent of 'average,' the distribution of radionuclides for 1974 (Table II-LVI) may also be atypical. Regardless, the emplacement of 9.5 million curies in presumably ordinary carbon-steel pipe at or slightly below land surface could lead to environmental releases in the future. Past experience with mild steel pipeline corrosion and the special precautions taken to avert similar problems and assure retrievable storage (for 20 years) of transuranics at RWMC, leads one to reject the concept at ANL unless long-term storage is specifically not intended. The conditional statement (page II-232) that 'prolonged life can be expected under identical exposure conditions' is presumptuous of variability found in nature. The final statement should also include this facility in the amp series showing gamma radiation intensities at various facilities (page II-13 to III-31)."

Response

The year 1974 was obviously an atypical year considering the number of curies previously emplaced in the ANL radioactive scrap and waste facility; but 1974 was, however, typical of expected future operations. For example, in 1975, 91,500 Ci were emplaced and in 1976, 61,500 Ci emplaced in the ANL radioactive scrap and waste facility. In 1974, less radioactive waste was generated from fuel handling and refabrication operations than in previous years when fuel reprocessing was in progress. From 1959 to 1965 the distribution of radionuclides

X.17 COMMENT LETTER (Continued)

Response (Continued)

in waste was about 50% mixed activation products (MAP) and 50% mixed fission products (MFP), while from 1970 on, the majority of the radionuclides were MAP with some MFP and transuranics.

The text indicates the waste materials (in their liners) can be retrieved and sent to RWMC if it is desirable to do so. ERDA is considering the various options available.

With respect to corrosion, destructive metallographic examinations have disclosed pitting of 0.004 in. depth in the 0.250-in.-thick walls of a liner. Radiation levels measured along side each liner in 1976 indicate that stored radioactivity in the RSWF had decayed to a total value of about 100,000 Ci. Additional details are included in Section II.A.9.d. of the final statement on radionuclide distribution and in recent inspections of the storage liners.

The RSWF is included in the map series showing gamma radiation intensities at various facilities (Fig. III-13).

X.17.23 Comment

"Considering the very high concentrations of activity (100,620 curies in 75 ft³) in solid waste stored at ANL-W for 1974, more information should be presented in the final statement as to how the material is stored, and whether this part of the waste management program can be improved. It would seem (Table II-IX) that 2,200 ft³ of wastes containing some 9,500,000 Ci should receive greater discussion than is evident in the draft statement. The operation of the solid waste systems described on pages II-46 through II-50 should also be related to the operation of the other solid waste burial/storage facilities at INEL. For example, how does the ANL-W and other solid or liquid radioactive waste management systems relate to the INEL Radioactive Waste Management Complex (page II-51)."

Response

In the final statement, discussion of the ANL-W solid radioactive waste (Section II.A.1) includes a cross reference to Section II.A.9.

The later section discusses all of the INEL solid radioactive waste complexes. In response to this comment, additional detail on the ANL-W radioactive scrap and waste facility has been included.

X.17.24 Comment

"Section III.C.3 discusses radioactive liquid waste transfer line leakage. In EPA's opinion, the use of an incident that has already occurred (Item 27, Appendix B) in the draft statement as the maximum leak that could be expected, does not include a satisfactory degree of conservatism. This leak resulted in the discharge of 14,000 gallons of the high-level waste and 30,000 curies of Cs-137 and Sr-90. Certain sections of the waste lines would therefore appear to be the weak spot in INEL's waste management system. In view of this condition, the final statement should include a more detailed description of the waste lines and an evaluation of the probabilities of similar or greater leaks in the future."

Response

The carbon steel line referred to in the description of this leak was not a waste line. The connection of the carbon steel line to an encased stainless steel waste line with only a single valve to prevent waste solution from entering the carbon steel line was the result of poor design. As part of a project to improve the waste tank farm and its associated waste piping, a complete review of all piping has been conducted. Only one other carbon steel

X.17 COMMENT LETTER (Continued)

Response (Continued)

line connecting through a single valve to a waste line was discovered and has now been disconnected. As a result of this review and corrective action, it is not possible for a similar leak to occur (in a carbon steel line) in the future. All other stainless steel waste lines have secondary containment lines leading to monitoring sumps which detect leaks from the primary lines before significant volumes of waste can leak out. It is believed that this thorough review and upgrading has precluded any comparable incident. Thus, the conservatism represented is that appropriate to having overlooked another design feature of comparable magnitude.

X.17.25 Comment

"Analysis of the impact from an abnormal condition uses the rupture of a HEPA filter at WCF as the 'worst-case accident' (page III-126). This rupture would result in the release of about 300 curies of mixed fission products. However, in the discussion of past releases, page B-3, Number 10, there is a release of 1,200 curies of fission products from the fuel element cutting facility at ICPP. No other mention of this facility was noted in the draft statement. Is it still operational? If so, would not the rupture of a HEPA at this location be the suitable 'worst-case accident'?"

Response

The fuel element cutting facility referred to has not operated since 1959. Under current design guidelines, a HEPA filter system would have to be provided for the facility, along with a backup system. Incidentally, the draft statement of the WCF filter failure mentions the APS system -- as a future project -- it is now operational; therefore, a release of 300 curies from a WCF filter failure is no longer a probable event. (If the WCF filter were to fail, the APS would prevent release of its contents to the atmosphere.)

X.17.26 Comment

"Past radioactive waste disposal practices were apparently inadequate at the chemical processing facility. For example, land within a kilometer of the ICPP (Figure III-9) and the TRA (Figure III-9) facilities are contaminated to a gamma exposure level of more than 100 mrem/year. The final statement should indicate what the current waste management practices are which will prevent these high values during future operations."

Response

The low-level ground contamination in a predominantly northeast-southwest direction from the ICPP stack is the result of buildup on the ground of low concentrations of radioactive particulate from stack effluent over the years. The installation of the Atmospheric Protection System, described in Section II.A.3.a, markedly reduces (by a factor of 10^2 to 10^3) the continued buildup of this particulate activity. This improvement, along with the changes which have instituted during the period 1975 through 1976, are discussed in Appendix E of the final statement.

X.17.27 Comment

"Page I-2, last sentence: The phrase 'most of the radionuclides' infers that the number of radionuclides trapped by absorbing layers is an adequate evaluator of the effectiveness of ponding radioactive wastes in protecting the environment. The final statement should emphasize containment of all radionuclides capable of increasing the environmental radiation dose levels to individuals or populations."

X.17 COMMENT LETTER (Continued)

Response

This summary statement has been clarified in the final statement. The details concerning radionuclides found in the aquifer beneath the disposal pond areas are given in Section III.B.3.

X.17.28 Comment

"Page I-11: The last paragraph indicates that tritium and strontium are 'the principal radio-isotopes released in solution.' It should be emphasized that the term 'principal' means no other radionuclide is at a higher fraction of the value of the federal or state standard for concentrations released to uncontrolled areas. Some clarification of the relative importance of radionuclides as fractions of release limits or in terms of annual organ or whole body dose should be included in the final statement."

Response

The final statement has been clarified to emphasize that all radionuclides released to the aquifer are well below drinking water standards. In addition, the concentration of the six identifiable radionuclides in the aquifer, i.e., tritium, strontium-90, plutonium-238, plutonium-239-240, and Iodine-129 are represented as fractions of drinking water standards. These discussions are found in Section III.B.3.

X.17.29 Comment

"Page II-116: The ICPP discharge well monitoring system includes both gross beta and gamma scintillation sensors and the collection of a daily sample composited for monthly laboratory analysis. The draft statement does not indicate whether plutonium or other transuranic determinations are made. Some assurance of the absence of plutonium or other transuranics in the ICPP well discharge seems appropriate either on the monthly composite sample or by some other suitable monitoring procedure. The final statement should address these concerns."

Response

Prior to 1974, trace levels of alpha activity were detected routinely by radiochemical analysis of monthly proportional composite samples of ICPP liquid waste effluent. The levels were below the controlled area RCG for unidentified alpha emitters. During 1974, however, the decision was made to identify all "significant" constituents of previously "unidentified" effluent activity even though the levels were far below RCG. This "unidentified alpha" was found to consist entirely (within the limitations of the analysis method employed) of plutonium-238 and plutonium 239-240. Although other transuranic nuclides are undoubtedly present in extremely minute concentrations, analyses are not made routinely because of both cost and concentration versus hazard relative to the more prevalent plutonium. The 1974 values of plutonium are included in the appropriate tables, although they are very low. In addition, those isotopes are included in the updated tables (see Appendix E) for years 1975 and 1976.

X.17.30 Comment

"Page II-118: How do the major pH changes effect sorption assumptions?"

Response

Table II-26 lists the approximate pH of individual waste streams. Although these streams vary widely in pH, they are manifolded together prior to introduction to the disposal well. The average pH of combined waste streams at the point of discharge to the well during 1974 was 7.4, with monthly extremes of 8.6 and 6.8. The principal plant waste water stream contributing

X.17 COMMENT LETTER (Continued)

Response (Continued)

to the volume of material going down the well was, however, inadvertently omitted from Table II-26. It is approximately 1 million gallons per day of cooling water, and it markedly modifies the pH of any other streams of relatively much smaller volume with which it is combined. This important consideration has been corrected in the final statement.

Although wide ranges in the pH of ICPP waste disposal via the injection well do not occur, there is some information available to answer the question of how pH may affect sorption phenomena. D. W. Rhodes^[a] has studied the pH effect on natural earth materials. A summary of his findings follows.

The uptake of cesium-137 (in water) is not affected appreciably by varying the pH between 4 and 10 but drops off rather sharply below pH 3.7. In sodium chloride solution, uptake over the entire range of pH values is nearly constant and quite low compared to distilled water solution. The maximum uptake of strontium-90 occurs at about pH 10 and decreases rapidly with lowering pH. As with cesium-137, dramatic influences on uptake as a function of pH are induced by varying concentrations of cations in the carrier solution. The radionuclides Pu-239, Ce-144, Zr-Nb-95, Y-91, and Ru-106 exhibit maximum uptakes between approximately pH 4 and 8. Above pH 8, a region of reduced uptake occurs and persists up to at least pH 11 for most of the polyvalent radionuclides.

X.17.31 Comment

"Page II-152: The use of the LOFT Facility for testing of a reactor safety system involves an abnormal release of gaseous radionuclides which will be separately monitored by the ERDA Health Services Laboratory staff. EPA concludes that additional gamma or beta/gamma detection devices (mobile or stationary) are needed for in-plant radiation monitoring to provide improved real-time monitoring of planned and accidental gaseous releases from the numerous test facilities. Some discussion of this point in the final statement would be helpful."

Response

Text changes have been made (Section II.A.5) to reflect changes in plans and in experiments at the LOFT facility. Minimal failure of fuel is now anticipated and no blowdowns directly into the containment vessel are planned. Instead, all blowdowns will be made into a pressure-suppression system, which will retain any unplanned but small quantities of fission products released from fuel. The containment system will serve primarily as a backup, in event the suppression system were to leak. Both systems have been pretested for leak-tightness.

Eventually, after sufficient decay of gaseous fission products has occurred, the pressure system and the containment system will be vented to the atmosphere. But before this happens, in-plant radiation monitors and samplers will provide the necessary information on whether or not venting can be safely carried out, i.e., whether radiation levels are sufficiently low or whether further delay is needed to allow for additional radioactive decay. When venting occurs, the external ERDA-HSL monitoring system will provide confirmatory evidence of the safety of the venting. Additional details are found in Reference 40. The most important consideration, however, is that significant releases of fission products to the containment vessel would be unplanned and unexpected, but should they occur, adequate provisions have been made for their control before any release to the environment.

[a] D. W. Rhodes, Soil Science Society of America Proceedings, 21, 4 July-August 1957.

X.17 COMMENT LETTER (Continued)

X.17.32 Comment

"In reference to page III-61, the long-lived radionuclide I-129 has been reported as a source of thyroid radiation dose to antelope in the Idaho area. Although no effects in the health of individual grazing animals are expected from the current INEL releases, a continuing record of I-129 levels in an appropriate biological indicator sample such as the antelope thyroid can serve to document the extent of environmental buildup."

Response

This observation is correct and is explicitly acknowledged in the final statement. The purpose of the current I-129 research is to document the extent and amount of I-129 in the environment of INEL and vicinity by utilizing samples of deer and antelope thyroids. Jackrabbit and cottontail thyroids have also been sampled for I-129. Tentative future plans call for determining the I-129 in components (soil, vegetation, etc.) of the INEL ecosystem. These research programs should indicate what medium or animal is more appropriate to utilize as a long-term indicator of I-129 in the environment. Big game animals will continue to be used in the I-129 monitoring effort because of their relatively large thyroids and their availability for sampling.

X.17.33 Comment

"On page II-93, the concentration of tritium at the point of discharge to the groundwater for 1974 at INEL is reported as 3.2×10^{-4} $\mu\text{Ci/ml}$ or 320,000 pCi/liter. This value is 16 times the EPA limit for this radionuclide in a public water system (41 FR 28402). The average concentration of tritium at the CFA production well, presumably a drinking water source, was 70,000 pCi/liter, a value which also exceeds published EPA maximum contaminant levels for tritium. Also on page III-94, a mean concentration of dissolved solids of 500 ppm at the point of discharge to the aquifer is reported and indicated as meeting a water quality standard. The final statement should include discussion of the potential radiation dose from these levels. Also the comparison of these releases to EPA's interim regulations and how ERDA intends to reduce these release quantities should be discussed."

Response

Disposal of tritium contaminated liquid waste at INEL is in accordance with the current maximum permissible concentration allowed by ERDA Appendix 0524, for water released to an uncontrolled area. Concentrations of tritium are well below the state and Appendix 0524 limits. In Section III.B.3 the annual radiation dose experienced by persons at the Central Facilities Area who consume tritium contaminated water from the production well at CFA, which is the closest production well down gradient from the point of release of tritium at ICPP, is calculated to be 4.0 mrem. ERDA will continue to evaluate radioactive standards promulgated by other government agencies and take action as appropriate. Options are addressed in the revised Section V on alternatives of the final statement. They include head-end volatilization and trapping of tritium before it enters liquid waste, and use of evaporation ponds to release tritium to the atmosphere as tritiated water vapor instead of dispersing of it as liquid waste water in the aquifer.

X.17.34 Comment

"Page II-332. Where can summaries of the environmental monitoring program be found? A summary of the 1974 report should be included in the final statement."

Response

The summary of the environmental monitoring program has been included in Section II.C.12 of the final statement. Data from the 1974 INEL environmental monitoring report are found throughout

X.17 COMMENT LETTER (Continued)

Response (Continued)

Section III. In addition, Table I-2 is included in Section I of the final statement summarizing doses to man from all environmental pathways.

X.17.35 Comment

"In general, the draft statement describes activities of the facility in terms of waste disposal and defines past environmental consequences of these activities. It is apparent that considerable planning and research supports an overall conservative system for discharge of wastes into the regional aquifer. Discharge is essentially limited to tritium and concentrations that are within established guidelines. It is other, long-lived and more toxic radionuclides disposed of into the unsaturated zone via seepage ponds that are of greatest concern. Considering the technical constraints and state of development of predictive techniques, the draft statement is a commendable effort in disclosing future consequences of continuing the operation, even though it is admitted that existing predictive models cannot-look far enough into the future when dealing with these types of wastes. Although tritium is the dominant radionuclide (in terms of activity) introduced to an aquifer, twice as many curies are introduced to the unsaturated zone where no model is operative or in development. The final statement should discuss such a waste disposal practice and whether further evaluation is needed of the monitoring program to ensure adequacy in sampling locations, parameters, and frequencies. As a long-term environmental safeguard, predetermined limits should be established for each parameter at each monitoring site. When these limits are reached, that particular waste disposal site must be abandoned and proper restoration steps taken."

Response

A recent report by Robertson[a] contains a three segment numerical model of subsurface radioactive solute transport from ponds to the aquifer at TRA. This model provides detailed information on the transport of tritium and strontium-90. It also provides some information on the transport of cesium-137, cobalt-60, chromium-51, cerium-144, and nonradioactive wastes. While this report does not provide all the details concerning the fate of radioactive wastes discharged to ponds, it does agree adequately with the available field data. The model can be used to project subsurface distributions of waste solutes under a variety of assumed conditions for the future. Although chloride and tritium reached the aquifer several years ago, the model suggests that the more easily sorbed solutes, such as cesium-137 and strontium-90, would not reach the aquifer in detectable concentrations within 150 years for the conditions assumed. This study is summarized and referenced in Section III.B.3.

Based on the information available, the monitoring programs at TRA appear to be adequate in regard to sample location, sample frequency, and other parameters.

In evaluating the influences of the disposal of radioactive wastes, many factors are important. These factors include:

- (a) The half-life of the waste solute
- (b) The sorption properties of the solute and the host rocks
- (c) The dilution and dispersion in the subsurface
- (d) The quantities disposed

[a] J. B. Robertson, Numerical Modeling of Subsurface Radioactive Solute Transport from Waste-Seepage Ponds at INEL, IDO-22057 (January 1977). (Also USGS Open-file Report 76-7177.)

X.17 COMMENT LETTER (Continued)

Response (Continued)

- (e) The amount, velocity, and chemical character of the water in the aquifer.

The wastes discharged to the ponds at TRA do not constitute an identified problem to the Snake River Plain aquifer. They are either sorbed on the earth materials or rocks, have too short a half-life, or are not discharged in sufficient quantities.

Predetermined limits have not been established for each parameter for each disposal site at INEL. This idea should be valid in the future for some waste solutes in selected areas. Consideration will be given to this suggestion and plans may be formulated as to abandonment and restoration of sites.

X.17.36 Comment

"Insofar as the natural hydrogeologic features of INEL have a direct bearing on the waste disposal operations and vice versa, the discussion of such features (pages II-291 to II-311) needs to be expanded in the final statement. Incorporation of study findings, not referred thereto, should be made. The draft statement does not present an adequate disclosure of the natural features incorporated into and depended on for waste management. The statement needs additional hydrogeologic information to allow technical reviewers sufficient chemical data, maps, cross sections, etc., to better understand natural and contaminated conditions in the subsurface."

Response

The information is referenced in Section II.C.9 as Reference 76b, 76a, and 76:

R. L. Nace et al, Generalized Geologic Framework at the NRTS Idaho, USGS Professional Paper 725 B (1975).

E. H. Walker, Subsurface Geology of the NRTS Idaho, USGS Bulletin 1133-E (1964).

J. B. Robertson et al, The Influence of Liquid Waste Disposal on the Geochemistry of Water at the NRTS: 1952-70, USGS, IDO-22053 (1974).

The last report presents maps of the natural distribution of dissolved chemicals in water of the Snake River Plain aquifer (Figures 19-31). Study of these figures provides an excellent background of the chemical quality of water in the Snake River Plain aquifer that is unaffected by INEL operations. It also covers the geology and geochemistry in great detail.

X.17.37 Comment

"On page II-333, it is stated that 'reports on the USGS monitoring program are made periodically,' yet only one report covering an 18-year period from 1952 to 1970 is indicated. Are other reports available?

On the same page it is stated that 'a limited number of samples of INEL soil have been obtained and analyzed for radioactivity.' How many samples are available and what are the analysis parameters? What is the relationship of such sampling and analysis to the use of unsaturated soils for sorption of radionuclides? This extremely important aspect of the INEL waste management program should be more fully covered in the final statement."

X.17 COMMENT LETTER (Continued)

Response

Reports prepared by the U. S. Geological Survey covered the calendar year periods of 1961, 1962, 1963, 1964, 1965, 1966, from 1952 to 1970, and from 1971 to 1973. A report is being prepared for the years 1974 and 1975. In addition, topical reports have also been prepared. The later reports, describing present conditions, are referenced in the statement.

The USGS has collected only a few soil samples for radiochemical analyses. Most soil sampling has been carried out by the Environmental Sciences Branch of the ERDA-ID Health Services Laboratory. (It is presumed that the term soil in the comment is used to describe the thin layer of earth lying at and near the surface and supporting plant life). However, USGS has collected numerous samples of the materials from sedimentary layers interbedded in the underlying basalts, and has made studies of the physical and chemical properties of these materials, including cation exchange capacities and radionuclide content. Additional drilling (core) to collect sedimentary samples from beneath RWMC was conducted in 1975, 1976, and 1977. Additional details of the surface soil sampling program are included in Section II.C.12. It should be noted that the reliance on soils lying beneath disposal ponds to absorb radionuclides will, in the future, be discontinued. The use of these ponds is being phased out as discussed in Appendix E of the final statement.

X.17.38 Comment

"On page III-37, the statement, 'if the ICPP continues to release. . . is balanced by the yearly loss due to radioactive decay,' raises numerous questions. How much of an increase and over what time period can this be expected? What will the long-term prospect be for contamination of underlying bedrock (saturated and unsaturated zones)? What are the attendant long-term monitoring and land use controls?"

Response

The magnitude of the increase and time period to reach maximum levels are both treated in Section III.B.1. For Sr-90 and Cs-137, the highest equilibrium surface contamination at points of public access or permit grazing would be 130 and 300 nCi/m², respectively, and would occur in approximately 100 yr if ICPP continued to release airborne particulates at 1974 rates. Equilibrium levels of shorter-lived nuclides would be reached in about 3 yr. Contamination of the underlying aquifer would be undetectable from surface deposition and the downward migrations of the airborne radionuclides. Monitoring of air, soil, vegetation, groundwater, and other ecological indicators will continue indefinitely. Land use would not be restricted because of soil contamination outside of individual plant exclusion areas at any point on INEL.

X.17.39 Comment

"The statement should include groundwater monitoring data, other than those appearing in the contour map illustrations. Specific information on the quality of effluents and groundwater likely to be affected or already affected by seepage ponds, industrial waste ponds, and injection wells should be discussed in the final statement. The quality of potable supplies relative to natural (unaffected by waste disposal) quality should also be addressed. The sections on groundwater monitoring programs, per se, conducted in support of the many waste disposal operations should also be enlarged."

Response

The U. S. Geological Survey has collected a vast array of groundwater monitoring data at INEL since 1949. These include water level measurements, water quality analyses, well logs, rock samples, borehole geophysical logs, pumping and injection tests, and pumpage and disposal information. Much of this information is available in more than 70 USGS authored reports,

X.17 COMMENT LETTER (Continued)

Response (Continued)

many referenced in the final statement. Additional details are on file at the USGS office at INEL and are available upon request. Contour map illustrations, hydrographs, and other illustrations have been utilized in the final statement to graphically illustrate some of the more significant results of these data.

Detailed information on the quality of the effluents and the groundwater effected by disposal are available in reports by ERDA and USGS. This is the principal theme of one report^[a]. This report also contains illustrations that show the natural quality of water in the Snake River Plain aquifer. A comparison of these maps with maps showing the waste plumes readily outlines the effects of waste disposal. The model simulation reports by USGS indicate the areas where groundwater is likely to be affected by waste disposal. This report is Reference 76.

Text has been added to Section II.C.9.(9) to show the influence of waste disposal on the quality of potable supplies. For example, the chloride content of water from the wells at CFA has increased from less than 10 mg/l to more than 70 mg/l as a result of waste disposal at ICPP and TRA. However, the water quality of most potable supply wells on INEL has had little or no effect from nearby waste disposal.

The groundwater monitoring programs conducted around TRA, ICPP, and CFA are described in numerous reports and in some detail in the final statement. These areas constitute the major radiometric and chemical waste disposal points at INEL and have been studied in considerably more detail than any other areas. Therefore, these studies serve as pilot models to better understand the fate and migration of waste solutes in a fractured rock aquifer. The effects of disposal activities elsewhere at INEL would cover a much smaller area and would be attenuated. The monitoring systems around NRF, EBR-II, and TAN all show minimum or undetectable waste plumes. The detailed understanding of the waste disposal systems at TRA and ICPP and the associated groundwater monitoring programs are intended to serve as a representative example for the maximum waste conditions at INEL.

X.17.40 Comment

"On page II-44, Table II-V, the concentration of dissolved oxygen in the final effluent for September is unrealistically high. The EPA National Eutrophication Survey revealed that maximum dissolved oxygen concentrations in most lakes range from 10 to 13 parts per million, which is normal for aerated surface water bodies. The values of 37.5 ppm (Table II-V) appears anomalous and should be discussed."

Response

The data for this table have been rechecked and the value in question is corrected in the final statement.

X.17.41 Comment

"Table II-XI, page II-62 states that 92.1 percent of the non-tritium bearing effluent fractions released to NRF seepage basins consists of long-lived C-14 and unidentified beta-gamma emitters. The final statement should discuss what improvements seem warranted in the analytical effort, and/or long-term management, due to biologic recycling of C-14 and long half-life."

[a] J. B. Robertson et al, IDO-22053 (1974), Reference 76 of the final statement.

X.17 COMMENT LETTER (Continued)

Response

During 1974, only 0.0004 Ci of C-14 was released to the NRF seepage basins. The C-14 concentration is more than a factor of 1000 below the permissible concentration of soluble C-14 to an unrestricted area. The low value reflects the past efforts to reduce effluents to as low as practicable. Continuing efforts are being made to reduce all effluents, however, the cost-benefit trade-off of additional reductions of C-14 releases is marginal. The releases will continue to be evaluated and technological advances will be applied as they are developed to further reduce these small releases.

X.17.42 Comment

"On page II-170, for the Power Burst Facility (PBF) liquid waste discharge: How do the concentrations of radionuclides with half-lives of less than 30 days compare to the concentration guides for drinking water. Also, what volume of radioactive effluent will be discharged during an average year of operations?"

Response

The data presented in Table II-43 indeed did not include radionuclides with half-lives less than 30 days. Like the longer half-life nuclides listed in the table, shorter-lived nuclides are also well below drinking water concentrations. Should any individual radionuclide in the radioactive liquid waste be shown by analysis to exceed drinking water concentrations, the waste is shipped to ICPP for evaporation and is not discharged via the PBF disposal well. The annual volume of radioactive liquid waste disposed to the PBF well is about 42,000 gallons, based on actual CY-1975 experience. Section II.A.6.c has been clarified on these points.

X.17.43 Comment

"The statement on page II-118 'The concentration of chemicals released to the discharge well is below maximum concentrations allowed in state and federal standards for drinking water as shown in Table II-XXVII,' does not seem consistent with concentrations shown in Table II-XXVI. The final statement should clarify this."

Response

Omitted from Table II-26 was any reference to the principal plant waste water stream (condenser cooling water) at a rate of about 10^6 gallons/day. This is corrected in the final statement. Chemical concentrations in the effluent stream released to the injection well are typically as presented in Table II-27.

X.17.44 Comment

"On page II-158, the statement ' . . . dispersion of the waste water in the aquifer is expected to further reduce the tabled concentration' is contrary to the intent of the Safe Drinking Act with respect to groundwater in which the subsurface is used as part of the waste treatment. The same concept holds true for waste heat on page II-162."

Response

The dilution is noted as a fact, not as a means of reducing the environmental impact. Clarifying wording changes have been made in Section II.A.5.

X.17.45 Comment

"The quality of the nonradioactive waste from the PBF should be discussed (page II-173). Removal of contaminants by ion exchange should not be the method of waste treatment."

X.17 COMMENT LETTER (Continued)

Response

At the end of CY-1974 PBF had just begun low-level testing and was not fully operational. The exact quality of the nonradioactive waste was undetermined and therefore only a semi-qualitative discussion could be presented in the draft statement. Existing real data now have been evaluated and meaningful quantitative data are presented in the final statement. It should be noted that the use of the 116 foot disposal well for disposal of nonradioactive waste will soon be discontinued. Instead, a lined evaporation pond, discussed in Appendix E, will be used and the nonradioactive solids will no longer be transferred to the ground at PBF. Thus reliance on soil ion exchange will no longer apply.

X.17.46 Comment

"On page II-193: The final statement should indicate what the volume of discharge is from the retention basin at TRA. Also, state what radionuclides are present and the activity of each."

Response

The requested information is presented in Section II.A.7 of the final statement. The discharged volume is 15 to 20 million gallons per month. The radionuclides, and their activity, discharged through the retention basin are presented in this same section.

X.17.47 Comment

"The last sentence on page II-194 incorrectly infers that all radionuclides are retained in the soil beneath the leaching (seepage) ponds. For example, in 1974, Cr-51 and H-3 constituted 1,584 curies or 88.4 percent of the total inventory. Both radionuclides are particularly mobile and could be expected to reach the water table. The final statement should address the following two concerns. First, release of radionuclides to the water table should be justified with respect to the intent of PL-93-523. Secondly, future mobility of radionuclides in the soil column should be ascertained."

Response

The sentence was ~~not~~ meant to imply that all radioactive impurities are retained in the soil. This sentence is clarified in the final statement to state that some radioactivity is retained in the soil beneath the ponds. The impact of the radionuclides upon the environment (including the water table) is presented in the final statement in Section III.B.3. With respect to future use of the TRA ponds, there is now in planning a water purification and recycle program which will make the use of the ponds unnecessary. This program is discussed in Appendix E of the final statement.

After discharge of waste to the ponds is discontinued the ponds will "dry up." To prevent resuspension of dry pond-bottom soil as airborne dust it is probable that the ponds will require covering with uncontaminated soil. A series of core drillings may be necessary to evaluate the distribution of subsurface radioactivity; sampling and analyses of any perched water remaining will continue using existing wells or new wells. Similarly aquifer sampling will continue. Final plans have not yet been made to carry on the aforementioned stabilization since complete recycle of waste water will not be achieved before 1982. ERDA intends to maintain a sensitive awareness to the problem of future mobility of radioactivity in the subsurface regions beneath the ponds and will have a sampling and analysis program attuned to the needs of the situation as it develops.

X.17 COMMENT LETTER (Continued)

X.17.48 Comment

"On page II-199 the use of the injection well for disposal of nonradioactive wastes introduced (up to September 1972) large quantities of hexavalent chromium to the basalt aquifer and a large plume of chromium contaminated groundwater developed. The final statement should comment on the current extent and concentration of chromium contaminated groundwater and why a well is used versus a seepage basin. What was the chromium concentration and total quantity previously injected? What are the adverse effects, if any, of chromium contamination present in the aquifer as a result of disposal operations?"

Response

The use of chromate as a corrosion inhibitor at TRA ceased in September 1972 and none is currently put down the TRA injection well. The distribution, along with concentrations, of chromium in the aquifer is illustrated in figures and discussed in Section III.B.4 of the final statement.

The total chromium content of water in the Snake River Plain aquifer has been mapped in 1976. The plume of total chromium extends from TRA southward beyond CFA. Much of the plume is below drinking water standards of 0.05 mg/l for total chromium. The waste plume will continue to be diluted and dispersed which will lower the concentrations. However, in an area about one-half mile south of TRA, the total chromium content of water from the aquifer is about 0.4 mg/l. Further, there are no production wells in the area in which chromium was earlier found to be in excess of standard drinking water limits.

X.17.49 Comment

"On page II-200, the statement 'This has resulted in an increase in the concentration of dissolved solids in the groundwater in the immediate area of the pond,' should be fully explained. In addition what data are available and what is the quality of the nonradioactive waste?"

Response

A full explanation of the effects of increasing the concentration of dissolved salts in the groundwater is found in Section III.B.4 of the final statement. Reference 76 presents the subject in more detail.

X.17.50 Comment

"Pages II-278 to II-283: Evaporation data should be supplied. It would also be useful to discuss the principal recharge sources and mechanisms affecting replenishment of the soil moisture zone and the regional aquifer."

Response

While extensive evaporation data have not been collected concerning INEL, evaporation information is available from Aberdeen and Kimberly, Idaho. The average annual evaporation rate for ponds at INEL is about 3.0 ft/yr. About 80% of this (2.4 ft/yr) occurs from May through October. Information on evaporation is included in Section II.C.6. Recharge sources are discussed in Section II.C.9 of the final statement.

A report by Barraclough et al (1976) presents a detailed evaluation of the principal recharge sources and mechanisms affecting the replenishment of the soil moisture zone and downward migration of water to the regional aquifer. This report is Reference 110 in the final statement.

X.17 COMMENT LETTER (Continued)

X.17.51 Comment

"On page II-302, the statement 'The most significant body of perched water resulting from waste disposal occurs at TRA beneath the waste seepage ponds' should be further explained. What is the quality of water in the perched zone, how does it affect the aquifer, etc.?"

Response

The discharge of liquid waste to the TRA waste-seepage ponds has resulted in a large perched-water body beneath the ponds. This is because of the large quantity of water discharged (nearly 1 million gallons per day) and the geohydrologic conditions beneath the ponds (which retard the downward flow of the water and cause it to form a "perched" body).

The quality of water in the perched zone is given in Section III.B.3. Additional information is shown in a report^[a] by Barraclough and Jensen, Figures 27, 28, 29, 30, and 31 (Reference 75a).

Water from the perched water body moves downward to the Snake River Plain aquifer. Figures in Section III.B.3 illustrate the concentration in the Snake River Plain aquifer of wastes derived from the TRA ponds (the waste plumes also show wastes from the ICP well). The geohydrologic system is described in this same section.

X.17.52 Comment

"On page II-305 the statement, 'The chemical content of the water indicates from which pond the water is derived' should be explained and relevant analytical data provided."

Response

Waters of different chemical and radiometric content are discharged to the ponds at TRA. The chemical waste disposal pond (Figure II-67) receives sufficient chemicals so that the perched water beneath that pond is high in specific conductance (Barraclough and Jensen, 1976, Figure 32)^[b] and chloride (Robertson and others, 1974, Figure 47).^[c]

The radioactive waste disposal pond receives radioactive wastes. This waste is represented on maps of the radiometric concentrations of the perched water in the basalt. The tritium concentration is shown on Figures 27 and 28 (Barraclough and Jensen, 1976); the chromium-51 concentration is shown on Figure 29; the cobalt-60 concentration on Figure 30; and the strontium-90 concentration is shown on Figure 31.

By comparison of these maps, the chemical and radiometric concentrations of the perched water can be used to infer which pond was the principal source of perched water.

Clarification is provided in the text, Section III.C.9 and the two documents are referenced: References 75a and 76.

[a] J. T. Barraclough and R. G. Jensen, Hydrologic Data for the INEL-Site, Idaho, 1971-73, IDO-22055 (1976).

[b] J. T. Barraclough and R. G. Jensen, Hydrologic Data for the INEL-Site, Idaho, 1971-73, IDO-22055 (1976).

[c] J. B. Robertson et al, IDO-22053 (1974).

X.17 COMMENT LETTER (Continued)

X.17.53 Comment

"On page III-72, there is a sizeable discrepancy between the 1964 data in Table II-XXXVI for total activity releases (2,640 Ci) at TRA and ICPP and the 3,998 Ci reported in the Hydrology of NRTS Annual Progress Report for 1965 (page 79). This should be clarified in the final statement."

Response

There is indeed a discrepancy, as pointed out. Before the institution of the INEL Computerized Waste Management Information (WMIS) reporting system, the practices of reporting releases varied from year to year and from one facility to another. For example, one facility might include in the value of curies released, the sum of the parent and daughter activities of a longer-lived parent in secular equilibrium (or transient equilibrium) with a short-lived daughter. A second facility might include only the parent activity. After the WMIS system was put into effect, uniform reporting practices were required. At that time, the past summaries were reviewed and numbers revised to conform to the now-accepted reporting system. Also in the distant past, release values included short-lived nuclides which were not actually measured but were estimated only. The values quoted in the final statement are taken from the correct, official values of the WMIS reports.

X.17.54 Comment

"In our opinion there is a need for greater discussion of the geologic system underlying INEL as it may affect the validity and interpretation of the chemical data. Nace et al, (1959, page 72) note in their discussion of the variable specific capacity of wells that great differences in aquifer transmissivity occur through very short vertical distances. At NRF, one well had a specific capacity of 16 (gpm/foot drawdown) at a depth of 485 feet. When the well was deepened to 535 feet, the specific capacity was 2,860. It follows, then, that certain highly permeable zones account for essentially all of the transmissivity present. Therefore, how realistic are the chemical data from a well penetrating several or many such zones in describing the maximum concentration in a specific zone versus the average concentration over many zones? Work by Jones (1961, page D-375) revealed that chloride differences of 70 to 80 mg/l were observed in different zones of the same well when sampling involved use of a straddle packer or piezometers. For radionuclides, in particular, maximum concentrations are certainly of interest. Peckham (1961) noted that sampling involved with a bailer versus a thief sampler introduced a large source of error. He also mentioned (page 161) that Ru-106 detected in the ICPP area was recirculating from the disposal well through the upgradient production wells as a result of heavy pumping and injection via the upgradient disposal well. The final statement should include these discussions and address their relationship to EPA's concern."

Response

Variability of details of structure within the aquifer is acknowledged; irregularities are expected over short vertical or horizontal distances. Over longer distances, sufficient mixing appears to take place, however, so that available interpretations of chemical data are generally representative of the distribution of waste products in the aquifer. For this reason, additional details have not been included.

Collecting one "representative" water sample from a fractured-rock aquifer does appear to be less than precise and a small zone of the highest concentration could be missed. Before a single sample location is selected or changed, considerable data are available to help determine where the sample will be collected. Several geophysical logs are available including: gamma-ray, gamma-gamma, neutron-epithermal neutron, caliper, flowmeter, water temperature, and water conductivity. These logs and other data enable general selection of a water sample that is representative. In 1961 detailed studies were made by Jones (as cited in the comment)

X.17 COMMENT LETTER (Continued)

Response (Continued)

of waste migration around the ICPP. In those studies, inflatable packers were used to isolate what was then termed "aquifer D." Later, all of the packers were removed and results were very similar to those obtained earlier. This illustrates the natural mixing that takes place in the aquifer whether one zone is isolated or not. When a sampling well is equipped with a large pump, the pump may draw water from several zones and the water sample is a composite of these zones. It is believed that a self-flushing "thief" sampler used with care in open wells at INEL is the preferred method of collecting most water samples especially when all available information is used to select the best location in the wells for one water sample. Additional in-place samples could be collected from the same well which would substantially increase the time of collection and number of analyses. The advantages are deemed marginal.

The Ru-106 that Peckham noted in the ICPP production well in 1959 may not have been a result of recirculation but might have been derived from a body of perched water near the production well.

X.17.55 Comment

"The dilution, to date, as typified in the chemical quality maps (page III-80) may be apparent rather than real in terms of the total interval (aquifers and aquitards) sampled. Jones and Shuter (1962) noted that the tritium data were indicative of more dilution than was originally thought. Is this the case or are the contaminants localized along highly permeable zones, particularly between principal lava flows? The latter is reported by Peckham (1961). The indication in the draft statement is that concentrations of Sr-90, Co-60, H-3, etc., in the monitoring wells are relatively constant. If this is not the case, the final statement should include some discussion of this variability and a comparison to applicable standards."

Response

There is a vast amount of data taken since 1961-62 that shows that the dilution of chemical and radioactive wastes is real rather than apparent. Since that time more monitoring wells have been drilled, waste plumes have been mapped, borehole geophysical studies have been completed to determine permeable zones in each well, internal flow patterns have been measured, water samples have been collected from various depths from some wells and analyzed, pumps have been installed in some wells, and the waste plumes have been simulated with digital modeling techniques. These detailed studies all indicate that the dilution is a result of the wide dispersion angle of the waste plume in the aquifer.

There is no information to suggest that the contaminants are localized along highly permeable zones between lava flows and that the water samples collected are missing these localized zones. In the Snake River Plain aquifer, conditions vary markedly over a small area. When a larger area is studied, the geohydrologic conditions seem to be more predictable and follow hydrologic principles.

Over most of the area covered by the waste plumes, the concentrations of the radioactive and chemical waste constituents are rather uniform, both in the perched-water body and in the Snake River Plain aquifer. Some variations are the result of changing concentrations of the wastes discharged, radioactive decay, dilution from recharge such as from the Big Lost River, etc. In summary, the maps of the chemical and radiometric wastes shown by the waste plumes are rather constant, some of the constituents are redundant in duplicating the others, there are few anomalous values, and most geohydrologic reviewers feel that the waste patterns, while not accurate in every small area, generally represent the distribution of waste products in the aquifer. More detailed discussion is found in J. B. Robertson, Numerical Modeling of Subsurface Radioactive Solute Transport from Waste Seepage Ponds at INEL, IDO-22057 (January 1977), and cross-references listed therein. This reference has been included as Reference 104a of the final statement.

X.17 COMMENT LETTER (Continued)

X.17.56 Comment

"Considering the assumptions embodied in the theoretical approaches (Theis nonequilibrium formula, Thiem formula, and Jacob formula) to determining aquifer constants, there is need to explain the application of such techniques to INEL where wells are only partially penetrating and where aquifers are not homogeneous. Permissible distances between disposal and supply wells (Nace et al, 1959) have been determined using variations of these formulas, yet Nace et al, (1959) noted that the 'real margin of safety, if any, is indeterminable' and that 'if pumping and injection patterns change, there is need for recalculation.' Considering the changing patterns of pumping at TRA and NRF (Barracough and Jensen, 1976), the final statement should include some discussion of the effects, if any, on withdrawing potable water and injecting waste water into the same aquifer."

Response

The early studies at INEL made a considerable effort to determine the hydraulic properties of the Snake River Plain aquifer. These hydraulic properties are based on ideal conditions which do not prevail in any aquifer. The basalt at INEL is heterogeneous and anisotropic (that is, its permeability varies greatly from place to place and with depth and direction of flow).

Permeable zones are concentrated along the contacts between separate basalt flows and joints and fractures are irregularly distributed throughout the basalt. The vertical permeability of the basalt is smaller than the horizontal. Dense layers of rather impermeable basalt and fine grained interbeds separate adjacent permeable zones. All the wells at INEL do not penetrate the entire thickness of the formation (partially penetrating). Therefore, application of hydraulic properties from theoretical approaches to the Snake River Plain aquifer requires judgment based on knowledge of geologic conditions so that meaningful values can be determined. The earlier studies utilized such knowledge to develop useful approximations of average conditions. In fact, Dr. C. V. Theis, who developed the Theis nonequilibrium formula, served as a staff scientist for the project during this time.

Application of such techniques at INEL has been used as a guide to assist in well location. For example, Nace et al, 1959, pages 97-98, calculated that the permissible spacing for the ICPP pumping and disposal wells was 580 ft based on the hydraulic properties of the aquifer. The actual spacing is 1,800 ft. The permissible spacing for the TRA pumping and disposal wells calculated by using the hydraulic properties is 115 ft and the actual spacing is 1,650 ft. If the wells were drilled deeper, the aquifer properties (transmissivity) would usually increase, which would decrease the "permissible spacing." Therefore, generally a wide margin of safety has been added to the permissible spacing as can be calculated from the hydraulic properties.

A review of the effects of pumping and disposal operations at INEL shows that most plant areas have not caused problems. In fact, formation of perched water bodies at TRA and ICPP have caused more concern to pumping wells than have disposal wells. The perched water has been formed from pond or shallow subsurface disposal.

The pumping patterns have changed over the years. However, the decreases and increases produce a rather small change in an aquifer with such high permeabilities. In the areas at INEL, where pumpage is decreased, the discharge of water to disposal wells is correspondingly decreased. Discharge of waste at ICPP and TRA have changed the quality of water produced at CFA. The water at CFA is potable and after almost 25 years of disposal, the water meets all the current drinking water standards. Pumping and disposal into the same aquifer generally produces the largest effect on the water quality from nearby wells at the same facility.

X.17 COMMENT LETTER (Continued)

X.17.57 Comment

"The labeling of the disposal well at ICPP as 'deep' is misleading. By comparison with 383 industrial disposal wells across the country (Louis Reeder & Associates, Tulsa, Oklahoma; personal communication) 71 percent of which exceeded 2,000 feet total depth as of January 1975, the ICPP well is quite shallow. Furthermore, there is only 140 feet of penetration, not into deep saline or brackish water, but rather into the regional water table which is one of the most prolific aquifers in the United States. Therefore, waste dilution and dispersion is the chief feature of the 'disposal' scheme. It is far more the convention in industry and in regulatory agencies to consider 'disposal via wells' as introduction into reservoirs of unuseable fluid with little chance of migration into potable supplies. The average content of total dissolved solids in the injection zone for most industrial waste disposal wells in the United States is over 10,000 mg/l versus 200 mg/l at INEL. The final statement should address the concern."

Response

The labeling of the ICPP disposal well as "deep" is omitted in the final statement.

X.17.58 Comment

"Schmalz (1959, page 1-2) reported that for the ICPP injection well 'until July of 1958 the radioactivity involved consisted mainly of iodine-131 with a daily average discharge of 0.8 curie with a peak of 38 curies.' He also stated that:

'Monthly average liquid concentrations for isotopes with a half-life longer than 10 days were maintained at less than three times the maximum permissible drinking water concentrations for continuous use, with the exception of a period from December 1958 through February 1959 when solutions containing strontium-90 were discharged which exceeded the maximum permissible concentrations as much as 225 times (December 9th). The average for the month of December (1958) was ten times MPC. These releases were unintentional and were caused by a leak which at the time was of unknown origin in the plant system. The release of December 9th consisted of a 'slug' of approximately 29 curies composed of 24.8 percent total strontium, (sixty percent of which was strontium-90); 50.2 percent cerium-144 and praseodymium-144; 14.3 percent zirconium and niobium-95; and 10.6 percent cesium-137. This release was detected in the monitoring wells . . .'

In contrast to the above findings from an earlier study, the draft statement (table on page II-115) reports significantly less activity for 1953 through 1957 (346 Ci or 0.24 Ci/day). The same is true with regard to accidental discharges from December 1958 through February 1959, when Sr-90 exceeded MPC by an average factor of 10, with one 'slug' containing 29 Ci of long-lived radionuclides. This accidental release is not mentioned in Appendix B. These disagreements should be resolved in the final statement."

Response

IDO-12011, Interim Report of Liquid Waste Disposal in the Vicinity of the Idaho Chemical Processing Plant (ICPP) by B. L. Schmalz, dated June 1959 was examined carefully with regard to the quote "until July of 1958 the radioactivity involved. . . ." The particular quote referred only to waste discharged during the year 1958 and did not refer to previous years' discharges. Radioactive annual liquid wastes discharged are as listed in Table III-17 for 1953 through 1974. The daily average from 1953 through 1957 (5 years) was about 0.19 Ci/day instead of the suggested 0.24 Ci/day.

The accidental release to the ICPP disposal well on December 9, 1958, was indeed omitted and is included in Appendix C in the final statement.

X.17 COMMENT LETTER (Continued)

X.17.59 Comment

"Although it appears that the Big Lost Creek diversion works to reduce the flooding problem with respect to the INEL operations, the final statement should contain one or more illustrations of the extent of flooding for floods of various credible return periods, including as a minimum the Standard Project Flood of the U. S. Army Corps of Engineers. Included in the related discussion should be an estimate of flow velocities and the duration of inundation for those parts of INEL affected."

Response

Additional information on this subject has been included in Section II.C.9 of the final statement.

X.17.60 Comment

"On page II-292, the discussion of the threat of flooding from Birch Creek to facilities at TAN should be expanded in the final statement. Does the runoff in 1969 represent the 10-year flood or the 50-year flood? What facilities are affected and in what way? The present discussion of flooding should be more closely related to effects on INEL facilities and operations."

Response

Additional information on this subject has been included in Section II.C.9 of the final statement.

X.17.61 Comment

"There does not seem to be any mention of the catastrophic failure of Mackay Dam and its effect on flooding, even taking into account the diversion works. Recent dam failures underscore the absolute necessity to consider such events, however improbable according to current estimates. The final statement should include an analysis of the failure of Mackay Dam in terms of immediate flooding impact and longer-term, groundwater recharge effects. Nace et al, (1959) have stated that 'failure of Mackay Dam would unleash a serious flood.'"

Response

A flood study by the U. S. Geological Survey was initiated October 1, 1976. The study is entitled "Hypothetical floods from a failure of Mackay Dam and the hydrologic consequences on facilities at the INEL, Idaho." A draft report of this study is to be issued in the summer of 1977. Information on the immediate flooding impact will be available at that time. The longer-term groundwater recharge effects will not be studied in this report.

X.17.62 Comment

"On page II-287, a conflicting statement appears in the discussion on seismology as compared to earlier sections of the statement. It is stated INEL is in a Seismic Zone 3 of the Uniform Building Code of the International Conference of Building Officials. Rather than being 'aseismic' as stated on pages II-96 and II-291, this is in fact a higher risk classification than Zone 2 which prevailed prior to 1970. Pages II-123 and II-96 also indicate that a maximum credible earthquake of 7-3/4 (Richter Scale) near Arco would produce ground acceleration in the calcined waste storage facility of about 0.33 g. The final statement should clarify these apparent conflicting statements. Potential damages from such ground motion are discussed (page II-124), hence the 'aseismic' status is questioned. Work by the U. S. Geological Survey and reported on by Nace et al (1975) does not support the inferences in the draft statement that INEL is free of major seismic risk. Figure II-61 on page II-288 indicates that INEL is in a Zone 3 seismic risk zone and that major damage from earthquakes can be expected. The conflicting remarks concerning the seismic risk hazard to INEL facilities and operations need further

X.17 COMMENT LETTER (Continued)

X.17.62 Comment (Continued)

discussion. Considering: (1) the proximity of high-level wastes (liquid and calcined) to saturated, highly permeable bedrock; (2) the inability to precisely predict earthquake occurrences in space, time, and intensity; (3) the meager factor of safety in engineered structures (see page II-94); and (4) the assumptions and shortcomings in theoretical evaluations of structural responses (see pages II-94 and II-124) considerably more testimony from outside experts, including the U. S. Geological Survey, is strongly recommended."

Response

A Seismic Probability Map of the United States was prepared in 1948 by F. P. Ulrich with the advice of seismologists throughout the United States and was issued by the Coast and Geodetic Survey in 1948. This map, revised in 1949, was adopted by the Pacific Coast Building Officials Conference for inclusion in the 1952 edition of the Uniform Building Code. Subsequent editions of the Uniform Building Code have included this map with no changes.

This map was withdrawn by the Coast and Geodetic Survey in 1952 as "subject to misinterpretation and too general to satisfy the requirements of many users." The Coast and Geodetic Survey has offered no other probability map.

In January 1969 S. T. Algermissen, then of the Coast and Geodetic Survey now with USGS, prepared a report entitled "Seismic Risk Studies in the United States." This report contained the Seismic Risk Map of the United States which is shown in an accompanying figure. The Seismic Risk Map is meant to be an interim revision of the original Coast and Geodetic Survey Seismic Probability Map. This map is actually more than a revision of the old map in that the factors used in constructing the new risk map are somewhat different from those considered in the original map.

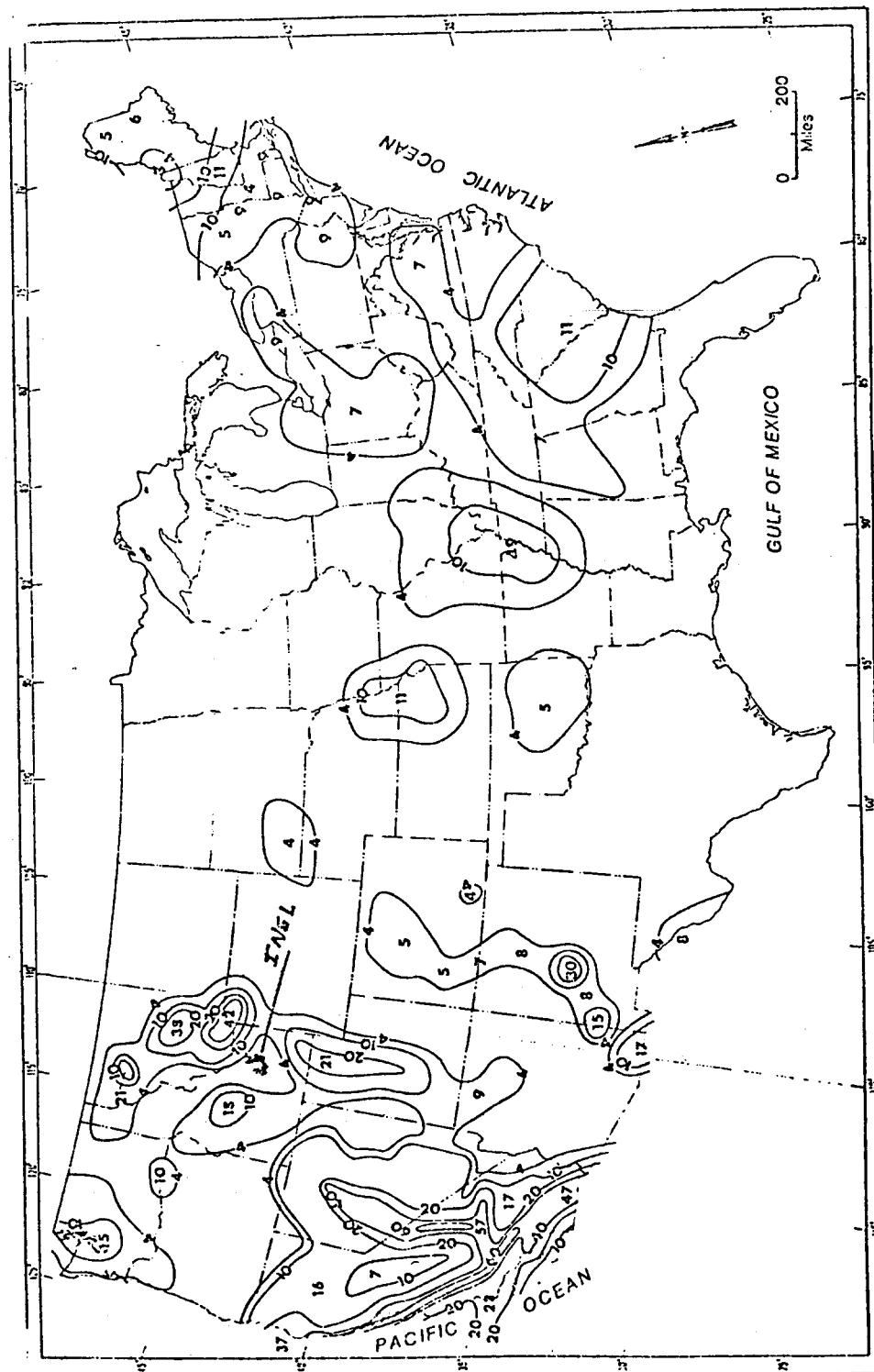
The Seismic Risk Map is based on the following factors:

- (a) The distribution of maximum Modified Mercalli (M.M.) intensities associated with the known seismic history of the United States
- (b) Strain release in the United States since 1900
- (c) The association of strain release patterns with large scale geologic features believed to be related to recent seismic activity.

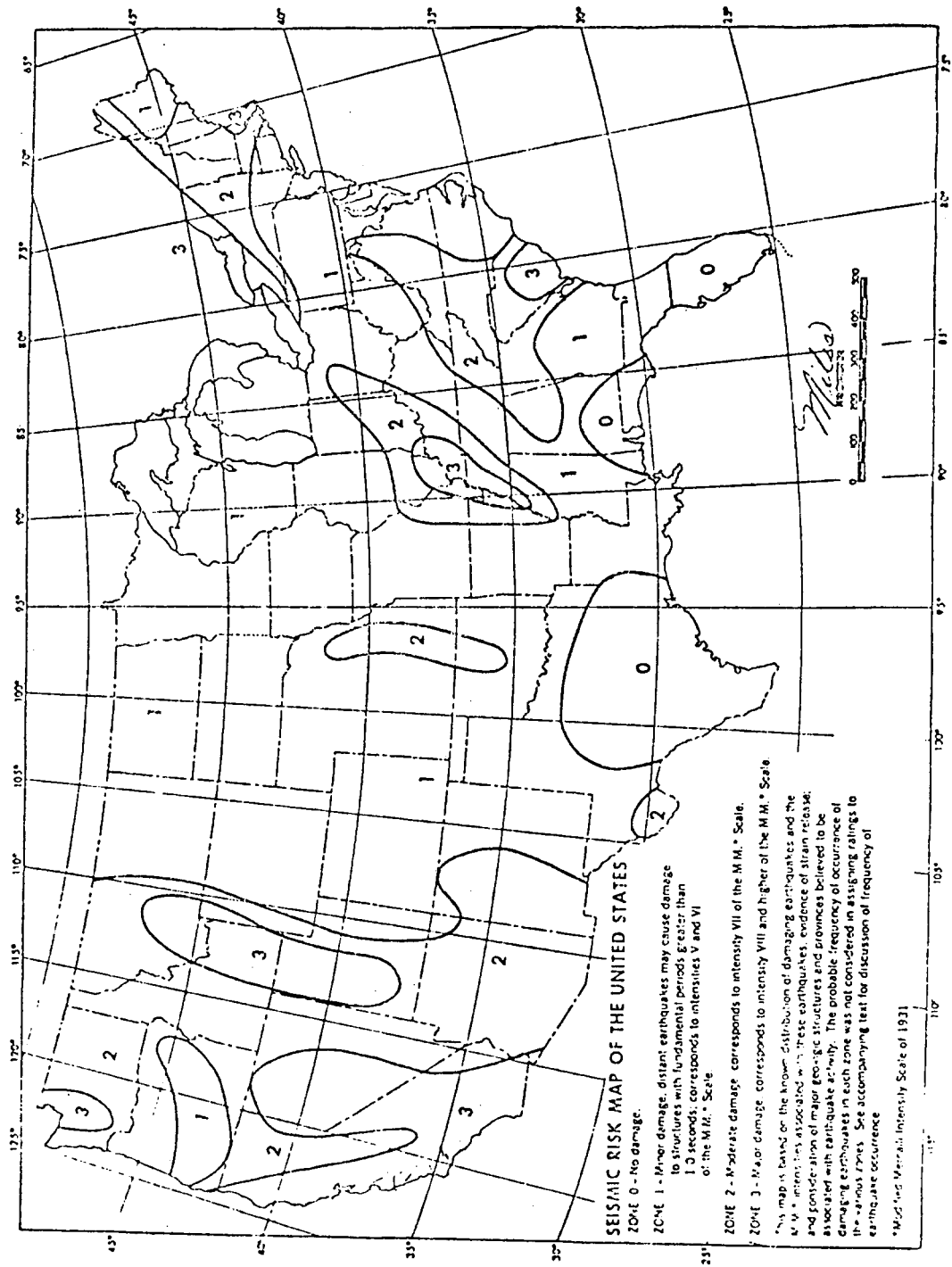
Where seismic activity has occurred intermittently along a recognizable geologic trend, it has been, in general, assumed that seismic activity could occur with equal likelihood anywhere along that trend or structure. In areas where the relations between seismicity and geologic structure are not clear or where only limited geologic information is available, the risk zones are based on the distribution of M.M. intensities and strain release. In all cases, the size and shape of the zones have been heavily influenced by the historical distribution of intensities.

The Zone 3 area restricted to southeastern Montana on the old map has been extended southward through Idaho and Utah. The large earthquake near Hebgen Lake, Montana in 1959; the Kosmo, Utah shock of 1934; the series of shocks in 1920 and 1921 near Elsinore, in southern Utah; and the related north-south trending faults amply justify the zoning.

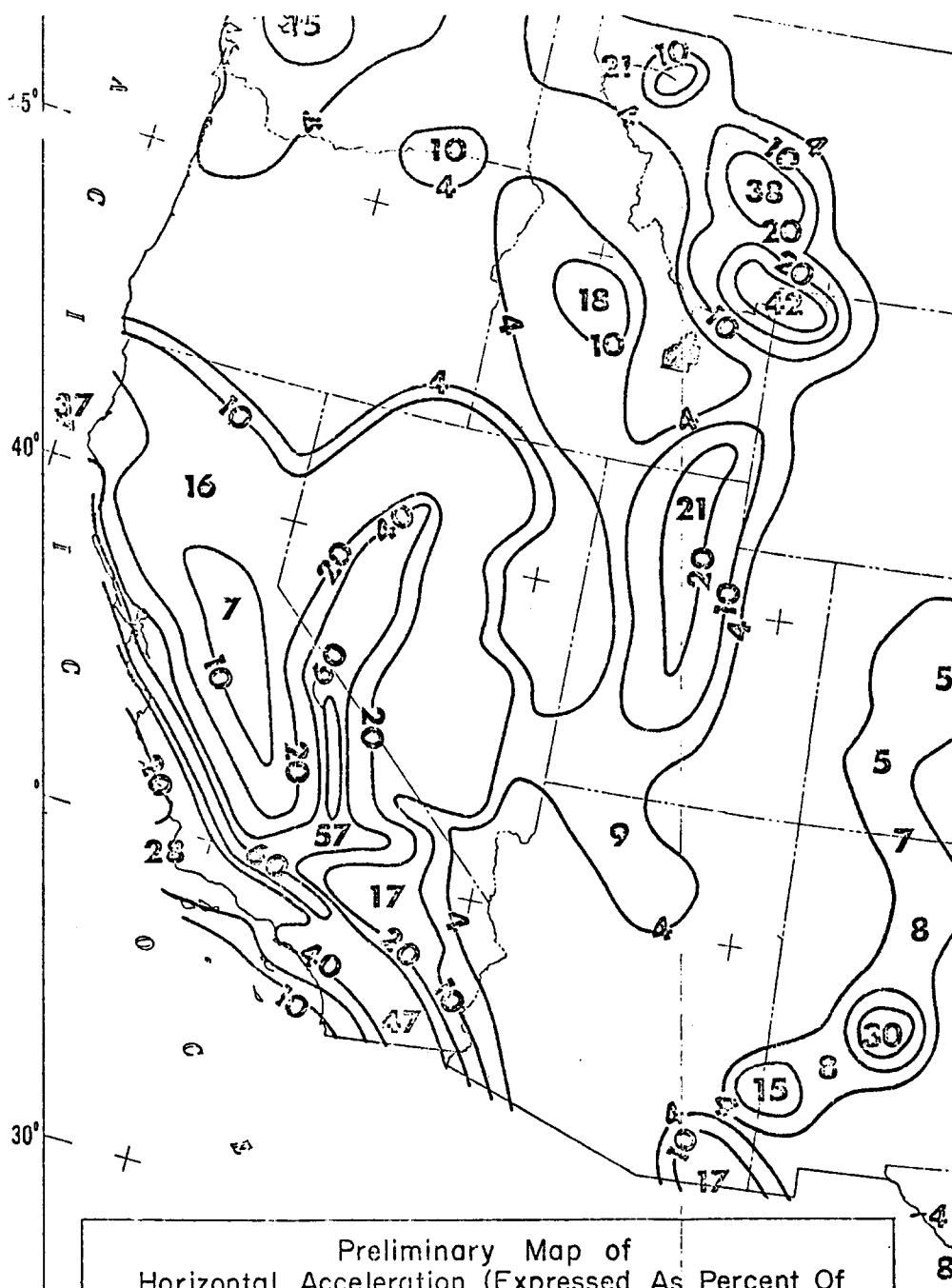
In 1970, the Seismic Risk Map by Algermissen was adopted by the Uniform Building Code of the International Conference of Building Officials and INEL was placed in Zone 3.



Map shows expectable levels of earthquake shaking hazards. Levels of ground shaking for different regions are shown by contour lines which express in percentages of the acceleration of gravity the maximum amount of shaking likely to occur at least once in a 50-year period.



Seismic Risk Map of the United States.



Preliminary Map of
Horizontal Acceleration (Expressed As Percent Of
Gravity) In Rock With 90 Percent Probability
Of Not Being Exceeded In 50 Years

The Maximum Acceleration Within The 60 Percent Contour Along The
San Andreas And Garlock Faults In California Is 80 Percent Of g.
(Using The Attenuation Curves Of Schnabel And Seed, 1973)

U.S. Geological Survey Open-File Report 76-416, 1976

This Report Is Preliminary And Has Not Been Edited Or Reviewed For Conformity With U.S. Geological Survey Standards

X.17 COMMENT LETTER (Continued)

Response (Continued)

In 1968 and 1969, the USGS made a nine month study of microearthquakes in the vicinity of INEL. No seismic activity was detected in the vicinity of INEL and they concluded that the area is currently aseismic. However, the absence of microearthquakes does not eliminate the possibility that the earth's crust in this region contains stored elastic strain that might be released, by slippage along a dormant fault, to produce an earthquake.

Since October 1972, ERDA and USGS have operated a network of three recording seismographs in southeastern Idaho. One station is on the Snake River Plain and two stations are in mountains near the plain. Data obtained to date tend to indicate that the Snake River Plain is aseismic and seismically "decoupled" from the mountains surrounding it. This information was not available when Algermissen prepared his map.

The "maximum credible earthquake" for the Arco or Howe faults was determined to be 7-3/4 by Woodward-Lundgren and Associates as outlined in a report on June 30, 1971. The report also gives a resultant rock acceleration of 45% of gravity for the ICPP, TRA, and PBF areas. Again, this information was prepared prior to the availability of the most detailed and most recent seismic information.

Recently, Algermissen and Perkins prepared a report entitled "A Probabilistic Estimate of Maximum Acceleration in Rock in the Contiguous United States," 1976 USGS open file report 76-416.

This report presents a probabilistic estimate of the maximum ground acceleration to be expected from earthquakes occurring in the contiguous United States. As was the 1969 Algermissen report, it is based primarily upon the historic seismic record. Geologic data, primarily distribution of faults, have been employed only to a minor extent, because most such data have not been interpreted yet with earthquake hazard evaluation in mind.

The principal map in the accompanying figure provides a preliminary estimate of the relative hazard in various parts of the country. The report provides a method for evaluating the relative importance of the many parameters and assumptions in hazard analysis. The map and methods of evaluation described reflect the current state of understanding and are intended to be useful for engineering purposes in reducing the effects of earthquakes on buildings and other structures. The maps show the acceleration (given in percent of the acceleration of gravity) in hard rock with 90% probability of not being exceeded in 50 years. That is there is only a 10% probability of these values being exceeded in 50 years. The map has contour levels which range from 0.04 g to 0.60 g. Below the 0.04 g contour level the ground shaking effects are largely controlled by earthquakes with magnitudes of 4.0 or less. Events of this size are incompletely recorded and it is difficult to estimate the recurrence rates for earthquakes of these magnitudes or smaller. Furthermore, it is likely that suitable attenuation functions will not produce accelerations larger than 0.04 g except in the immediate vicinity of the event. This limits their impact in the hazard calculation. In those regions of the map below the 0.04 g contour (such as INEL), wind loading of structures is expected to be the governing factor in the design of structures, so that earthquake shaking, at the level of hazard assumed, is not likely to be important.

The usefulness of the horizontal acceleration map is not so much in the absolute values of acceleration mapped but primarily because it provides insight into the relative hazard across the United States together with results concerning the relative importance of the various parameters involved. On this map, the horizontal acceleration is less than 4% of gravity over all of the INEL. Therefore, this map shows that the INEL is classed in an acceleration area which is as low as any area in the United States.

The earlier reports listed INEL in Zone 3, based primarily on the Hebgen Lake earthquake of 1959 (Richter magnitude 7.1). All the later studies seem to provide data and interpretations

X.17 COMMENT LETTER (Continued)

Response (Continued)

which suggest that the plain is rather aseismic. However, the Snake River Plain is certainly not free of seismic risk but all the factors suggest less risk than Zone 3. The salient points of the preceding discussion are summarized in the final statement.

The 1976 report is under study by the Applied Technology Council, a group funded by the National Science Foundation. Following review by this group, preliminary information suggests that the map showing the earthquake shaking hazards may be included in the Uniform Building Code.

X.17.63 Comment

"The final statement should include a discussion of the environmental impact from the calcined waste solids in the storage bins concerning the potential influx of water from rain or snowmelt, although evidently none has entered to date. In the case of the liquid waste storage tanks (page II-101) this was deemed a problem."

Response

The potential for significant influx of water from rain or snowmelt into the calcined waste solids storage bins is negligible. Design of the calcined solids vaults is in no way similar to the liquid waste storage tanks where there has been some slight in-leakage. The tops of the calcined solids storage bins are above grade and protected by a berm sloped to preclude water infiltration. The vaults contain provisions for detecting and transferring any in-leakage of water. Even if the water did seep into the vaults, the bins would prevent any contact of calcined solids with the water. The statement describes the resistance of the bins and vaults to earthquakes, tornados, flooding, etc., in Section II.A.3.e.

X.17.64 Comment

"With respect to long-term stability of the stored wastes, should inflow of water occur, it is mentioned (page II-124) that transuranic nuclides would be of concern. However, transuranic concentrations are not shown as a 'typical' property of the wastes in Table II-XXIX. The final statement should indicate which transuranic nuclides will be of concern. Finally, the blanket statement that 'absorption of transuranics by soil materials from the ground and/or surface water would prevent serious biological hazard to mankind' is highly speculative and heavily dependent on release conditions, land and water use patterns, and many other natural and man-related factors. This statement should be expanded further."

Response

The final statement includes the transuranic content of calcined wastes, omitted from the draft. Although inflow of water is a highly unlikely event, even if water did enter the vaults, the calcined waste storage bins are sealed stainless steel and admission of water to the waste itself is also very unlikely. It should be noted that should water enter a vault, it could be pumped out without it bothering the stainless steel storage bins. The speculative statement on absorption of transuranics by soil materials has been deleted from the final statement.

X.17.65 Comment

"The draft statement contains essentially no mention of whether or not recharge results from precipitation or snowmelt within the reservation boundaries. The NAS Committee (1966, page 71-72) was particularly concerned with the validity of the 'dry soil' zone concept and recommended that numerous additional studies be made. The conducted studies and their influence on the continuing reliance on sorption in the unsaturated zone should be developed in the final statement."

X.17 COMMENT LETTER (Continued)

Response

Some recharge to the Snake River Plain aquifer does result from direct precipitation on the Snake River Plain, but generally recharge from this source provides less than 10% of the recharge water added to the aquifer on an average annual basis^[a]. Recharge is mostly the result of rapid melt of a significant snowpack in the mountains.

Current studies by the U. S. Geological Survey are aimed at a better understanding of the principles and processes of water and solute migration in the unsaturated zone. The vertical pond model report by Robertson^[b] provides salient information on solute migration and sorption in the unsaturated zone beneath the TRA ponds. This report provides evidence that solute migration and sorption are generally understood or the numerical modeling would not simulate the field measurements as well as they do. Additional studies are planned to better understand the role of sorption and the transport mechanisms in the unsaturated zone.

X.17.66 Comment

"Page III-77, the indication of a strontium breakthrough at the TRA seepage ponds raises important concerns: (1) Beneath the regolith, the predominant material is basalt, not 'strata of soil-like, unconsolidated material in the basalt,' as stated in the draft statement. Basalt has essentially no sorptive capacity compared to soils and particularly clayey soils. The final statement should correct this misleading inference concerning the ability of basalt to retain radionuclides. (2) The statement 'the capacity of these underlying materials to "sorb" strontium has apparently not been exceeded' infers that great sorptive capacity is present. Although strontium has not been detailed in the aquifers, to date, there is need for evaluation of future conditions, too. The final statement should give a more definitive assessment of strontium distribution, migration rates, sampling data, potential for migration, influences from flooding, and sorptive capacity or regolith and basalt inter-flow materials."

Response

Beneath the TRA seepage ponds, the predominant material is basalt (75%) as the comment states. However, several sedimentary beds do occur in the basalt between the bottom of the perched water and the Snake River Plain aquifer. These sedimentary beds average 80 ft in thickness in a zone about 300 ft thick (from 150 to 450 ft below the pond surface). About 25% of the material in this zone is sedimentary. The sedimentary beds are shown in Figure II-68. They are considerably finer grained than the surface alluvial sandy gravel layer and would have a higher sorptive capacity.

Robertson^[c] (1977) estimates in his modeling studies that the average sorptive capacity for sediments was 20 times higher than that of the basalts. The average sorptive capacity of basalts is much lower than sediments as the comment states but it becomes important because of the relatively greater thickness of the basalt.

[a] M. J. Mundorff et al, Ground Water for Irrigation in the Snake River Basin in Idaho, USGS Water Supply Paper 1654 (1964).

[b] J. B. Robertson, Numerical Modeling of Subsurface Radioactive Solute Transport from Waste - Seepage Ponds at INEL, IDO-22057 (1977) (Also numbered Open File Report 76-77).

[c] J. B. Robertson, Numerical Modeling of Subsurface Radioactive Solute Transport from Waste-Seepage Ponds at the Idaho National Engineering Laboratory, USGS Open File Report 76-717, IDO-22057 (1977).

X.17 COMMENT LETTER (Continued)

Response (Continued)

Recent studies by Robertson (1977) have evaluated the past, current, and future conditions. Robertson has developed a three segment numerical model to simulate the TRA pond system. He has concluded that strontium-90 would not reach the Snake River Plain aquifer in detectable concentrations within 150 years, for the conditions assumed. These summary data are included in Section III.B.3.d. of the final statement and the Robertson report is referenced.

X.17.67 Comment

"Similarly, the final statement should give an assessment concerning the Co-60 retention in paragraph 3 of page III-77. It would be expected that other fission products such as Ce-144, Y-89, and possibly other less common elements may also present difficulties. There seems to be very little understanding of radionuclide retention beneath the TRA seepage ponds under present conditions."

Response

In a recent report, Robertson^[a] evaluated the retention of cobalt-60 beneath the TRA ponds. His studies indicated that Co-60 should behave similarly to Sr-90 except that it decays faster. Cobalt-60 distributions mapped from field data indicate that Co-60 may be a little more mobile than Sr-90. However, for the conditions assumed, the shorter half-life of Co-60 would ultimately prevent significant concentrations from entering the Snake River Plain aquifer.

Cerium-144 concentrations have been determined for the perched water beneath the TRA ponds. Only the water from one well near the pond contained detectable Ce-144. The sorptive capacity for Ce-144 is apparently higher than that for Sr-90 in the sediments at TRA. Sorption and a relatively short half-life of Ce-144 should prevent any measurable quantities from entering the Snake River Plain aquifer.

Barraclough and Jensen (1976)^[b] state that all other radioactive wastes (other than tritium, Sr-90, Co-60, Cr-51) discharged to the TRA ponds have not been detected in the perched groundwater. They are either sorbed on subsurface materials, have too short a half-life or are not discharged in sufficient quantities to be detectable. These factors would prevent these radioactive wastes from moving to the Snake River Plain aquifer, assuming the modeling conditions used in Robertson's report. This report provides an evaluation of the fate of radioactive waste beneath the TRA ponds in the future. These data are summarized in Section III.B.3.d. of the final statement.

X.17.68 Comment

"Although there is some discussion of accidental discharges from leaking pipelines, there is no comprehensive treatment of the pipeline corrosion situation. The detailed report by Paige (1972) revealed that buried piping surrounded directly by soil has an expected lifetime of 10 to 20 years. Leaks of less than 100 gallons per minute would be difficult to detect insofar as the capillary rise is insufficient to get fluids above the burial depths of five feet or more (to prevent freezing). In other instances, lines are buried beneath pavement, and in still other cases, the lines are used infrequently, thereby complicating monitoring by direct means or through materials balances. The high level waste lines to the hot waste storage tanks at TRA are a case in point. Paige (1972) indicates that the accuracy of volume

[a] See preceding comment for reference.

[b] J. T. Barraclough and R. G. Jensen, Hydrologic Data for the Idaho National Engineering Laboratory Site, Idaho - 1971-1973, USGS Open File Report 75-318, IDO-22055 (1976).

X.17 COMMENT LETTER (Continued)

X.17.68 Comment (Continued)

measurement for materials balances at the TRA tanks is poor and an improved system was proposed. The final statement should indicate whether this system was installed and the status of pipeline corrosion, leaking, and monitoring as part of the INEL operations. Also what improvements in the way of pipeline enclosures and construction, cathodic protection, corrosion testing, leak monitoring, etc., have been implemented as a result of the 1972 study?"

Response

The estimated expected lifetime of 10 to 20 years for pipelines, is for lines fabricated of black iron or ordinary steel. Pipelines carrying high-level waste (as at ICPP) or intermediate- or low-level waste (as at TRA) are made of stainless steel having an expected service lifetime of centuries. At ICPP the high-level waste lines are encased in secondary lines to collect and carry to a sump any leakage which may occur and to alert operations to the leak. The liquid waste storage improvement project in progress at ICPP is described in Appendix E. At TRA, the intermediate-level and low-level waste lines are stainless steel but not encased in a secondary line. (There are no high-level liquid wastes at TRA.) It is true that volume measuring equipment for the TRA tanks is less than adequate. Replacement of this equipment is part of the TRA water recycle and pollution control project the first phase of which is in construction. This project is also described in Appendix E of the final statement.

With respect to the cathodic protection system, installation is not so much for the purpose of safety as for the purpose of replacement-cost savings for carbon steel pipelines having low (10-20 years) expected service lifetimes when buried directly in soil. It should be noted that all pipelines carrying service water, fire protection water and the like are made of ordinary iron or steel and cathodic protection is appropriate for these lines.

X.17.69 Comment

"Many of the liquid transfer lines are doubly encased lines with monitored sumps. Throughout the draft statement, it is implied that the only monitoring for the leaks of the primary lines is by monitoring the sumps in the secondary encasement. However, accidental releases 26 and 27, pages B-6 and B-7, occurred with no apparent detection by the sump monitors. The final statement should indicate whether doubly encased lines were used; and if so, how effective is sump monitoring when these quantities of liquid can be released undetected. Are there other, similar transfer lines being used at present? Would not periodic hydrostatic testing be indicated for all transfer lines?"

Response

The leaks of April 1974 and of September 1975 were not from waste lines, but from lines (vent, drains, etc.) connected to waste lines. As such, these lines did not have secondary containment; therefore, the leaks could not be detected by a monitoring program. These instances were examples of poor design, and much effort has been expended to search out and eliminate similar connections.

The situation discovered in October 1974 would have been detected sooner had there been a regular program of checking containment sumps for the transfer piping in the tank farm. A monitoring program was started and is continuing, so that any leak to secondary containment should be discovered very soon after it occurs. The present monitoring is done once a week. Soon to be installed, however, will be continuous sump monitors connected to an alarm system. Description of this and other improvements to be made in the liquid waste storage improvement program at ICPP are found in Appendix E of the final statement.

X.17 COMMENT LETTER (Continued)

X.17.70 Comment

"A significant leak from a corroded carbon steel waste line resulted in the discharge of 14,000 gallons of high-level waste and 30,000 curies of Cs-137 and Sr-90. Certain sections of the waste lines would therefore appear to be the weak spot in INEL's waste management system. In view of this condition, we feel the final statement should include a more detailed description of the waste lines and an evaluation of the probabilities of similar leaks in the future."

Response

The carbon steel line which leaked 14,000 gallons of waste was not intended to be in contact with any waste. The connection of this line to a stainless steel waste line was the result of poor design; the entire system of waste lines in the tank farm area has been reviewed to eliminate similar or other design deficiencies. The basic system of waste lines is sound. A description of the safety features of these waste lines is described in Section II.A.3.c of the final statement.

X.17.71 Comment

"On page II-104 the draft statement indicates that the future anticipated liquid wastes will contain increased radionuclide concentrations. We would like the final statement to address whether the existing tank farm and associated piping, coolant systems, and monitoring apparatus are suitable for handling the waste concentrations and volumes of liquid wastes anticipated in the future. How much of an increase in volume and activity is expected?"

Response

The existing waste lines and tanks are suitable for the increase in radionuclide concentration that is likely to occur. The volume of waste generated will necessarily be limited to the amount of space available for waste storage. The new waste calcining facility will convert liquid waste to solid waste, so the additional waste storage space to be provided will be mainly for solid waste rather than liquid waste. As stated in Section II.A.3.c of the statement, "The changes proposed for the new calcining facility and the additional filtration to be provided by the Atmospheric Protection System will more than compensate for the anticipated increase in radionuclide concentration in the fuel." The projected range of waste generation which is felt to be covered by the concept of "continued operation of current programs" is discussed in the Foreword of the final statement.

X.17.72 Comment

"Pages II-90 to II-101 describe the ICPP high-level radioactive waste tank farm of nine 300,000-gallon tanks and two 318,000-gallon tanks of which only eight are equipped with internal cooling. The final statement should address how much reserve capacity with cooling and without cooling is available, and are these reserves adequate in the event of leaking tank(s)."

Response

Present policy requires that one spare cooled tank be held in reserve in the event that one of the other tanks should begin to leak. This tank could be used for cooled or uncooled waste - in other words, whatever the content volume of a leaking tank, it would be transferred to the spare tank. This is identified in Section II.A.3.

In addition to the spare tank, there is, at present, space in the remaining tanks equivalent to at least one additional 300,000-gallon tank. This is an operating reserve which is desirable to maintain.

X.17 COMMENT LETTER (Continued)

Response (Continued)

When the NWCF goes into operation, liquid waste will be calcined faster than it is generated. Therefore, additional spare capacity will become available within a relatively short period after the NWCF begins operation.

The effects of loss of cooling and cooling requirements of the high-level liquid waste tanks are presented in Section III.C.3.

X.17.73 Comment

"On page II-99, the description of the method of sampling the sumps seems extremely crude in relation to the importance of determining if a tank is leaking. The final statement should indicate whether there has been any leakage from the tanks to the concrete vault and the vault to the underlying basalt. Also, if a leak is discovered in any of the tanks and emptying is required, what minimum period of time is required, assuming a full tank?"

Response

This information is supplied in Section III.C.3. Refinements in instrumentation and in the operation of the tank vault sumps are being provided as a part of the ICPP liquid waste storage improvement program described in Appendix E.

X.17.74 Comment

"As a result of a brief study in 1970, the U. S. Public Health Service (PHS) was rather critical of the practice of mixing 1,000 cpm/ml or higher aged hot wastes with other waste streams (at TRA) to meet discharge standards. The final statement should indicate what changes in practices have occurred and if no changes were made, what was the justification. In the same study, the PHS was critical of the INEL policy of wastewater seepage/injection because it did not conform to State of Idaho regulations and Executive Order 11507 to reduce pollution to a minimum. They were also critical of the permissive attitude of not including deterioration of water quality as a form of water pollution. How have these practices changed and how is the continued discharge of wastewater into the subsurface justified?"

Response

Over the past few years, policies and attitudes on disposal of contaminated liquid wastes at INEL have changed markedly. Improvements in liquid waste disposal were under active consideration at the time of issue of the important policy document[a] WASH-1202 (73) dated July 1973. That document provided the stimulus for accelerating the liquid waste control upgrade program. Plans have been drawn up and are being implemented in a phased program extending over several years, to reduce both the volume of, and the radioactive content of liquid wastes disposed of at the TRA ponds. The ultimate goal of that program will be the complete elimination of the use of ponds shortly after FY-81. The important features of the program at TRA involve large reductions in the volumes of waste water, through recycle and cleanup of canal water (by ion-exchange beds) and by improved cleanup of primary reactor coolants, which are the chief source of radioactive contamination. Until the complete elimination of the use of these ponds, improvements are being made in monitoring radioactivity present in waste water disposed of via these ponds. Meanwhile, disposal of liquids via the ponds meets present applicable federal (ERDA Manual 0524) and State of Idaho standards. No radioactivity is directly injected into the Snake River Plain aquifer at TRA. At other installations, such as PBF, shallow injection wells are also scheduled for phase out, but at present, only liquids meeting appropriate standards are being routed to such wells. All facilities having liquid

[a] F. K. Pittman, Plan for the Management of AEC-Generated Radioactive Wastes, WASH-1202 (73) (July 1973).

X.17 COMMENT LETTER (Continued)

Response (Continued)

wastes of radioactive content exceeding present standards for disposal in an uncontrolled area are transferred to ICPP for evaporation. At ICPP the condensates from the evaporators are disposed of by injection into the aquifer, but their radioactivity levels are well below the standards for release. (To put current discharges to the lithosphere in perspective, it is pointed out that TRA and ICPP provide, together, 96% of the volume and 98% of the quantities of radioactivity discharged at INEL.)

The TRA water recycle upgrade program is discussed in Appendix E.

X.17.75 Comment

"The PHS (1970) noted that certain radionuclide concentrations in perched water beneath the TRA ponds equalled that in the open ponds, indicating that the sorptive capacity of the alluvium is much reduced. In 1966, the use of seepage ponds which received 10 percent of the ICPP wastes was discontinued when Sr-90 reached 10 $\mu\text{Ci/ml}$ in nearby monitoring wells. At the TRA seepage ponds, sorption data showed that only 1.6 Ci of Sr-90 were in the alluvium whereas 22 Ci were disposed of. The PHS (1970) concluded that Sr-90 was not well retained in the alluvium at TRA and that the empirical approach for pond utilization needs reevaluation and monitoring.

These studies and their relation to the continuing practices should be discussed in the final statement."

Response

The reference to the use of seepage ponds at ICPP is incorrect. Seepage ponds have never been employed at that facility. Perhaps the comment intended reference to the dry well used for a few years to dispose of canal waste water from the fuel storage building. The use of that dry well was discontinued in 1966 and contaminated water is now routed to the waste evaporators in another building for treatment prior to disposal via the ICPP injection well.

With respect to utilization of seepage ponds, that question has indeed been reevaluated. The use of seepage ponds for disposal of even low-level radioactive waste is being phased out at all plants at INEL. For example, major improvements at TRA scheduled in FY-1977 include recycling of ATR fuel storage canal water which is presently the largest contributor to the TRA disposal (seepage) ponds. In succeeding years, further projects are scheduled involving recycle and treatment of a number of waste streams from ATR, ETR, and the MTR laboratory areas, so that after FY-1981, total recycle is envisioned and the use of ponds eliminated. In the interim, extensive improvements are scheduled to intercept and retain the radioactive contaminants in those declining volumes of waste water disposed of via ponds. So not only will the volumes of waste disposed of in the ponds decrease, but the absolute number of curies of waste nuclides will also decrease during the period that the ponds are being phased out. This program is discussed in Appendix E.

Numerous studies both experimental (field investigations) and theoretical (model development) have been made of the distribution of radionuclides disposed of via seepage ponds. One of the more important ones is the Schmalz report which is Reference 104. In addition, a recent study by Robertson on this subject is referenced in the final statement. Robertson's data and modeling indicate that Sr-90 would not reach the Snake River Plain aquifer in 150 years. Summary data from these reports are included in the final statement.

The only radionuclide discharged to the TRA pond that is not subject to sorption reactions is tritium. The tritium concentrations of the perched water beneath the TRA ponds are sometimes as high as pond concentrations because of variations in the tritium discharge to the ponds. Therefore, the PHS conclusion regarding strontium-90 not being retained in the alluvium is not valid.

X.17 COMMENT LETTER (Continued)

X.17.76 Comment

"On page III-82, the draft statement indicates that sufficient Sr-90 was injected to raise the groundwater concentration to 0.2 pCi/ml (66 percent of the guide for drinking water). The final statement should address how this policy or decision to inject aligns with ERDA guidelines for waste disposal. If the seepage discharge of 1962 or 1963 is the cause of this elevated level of strontium, how is this done in regard to ERDA discharge policy? Was the pit in question normally used for radioactive waste? Was the soil mantle so thin that excavation for a new building resulted in removal of all soil and contained radioactivity (6 curies)? How much Cs-137 was contained in the sediments? Why was a new building located above the old seepage pit?"

Response

For the removal of dissolved salts as well as for removal of low concentrations of radionuclides from the fuel basin, the seepage pit in question was operated from 1951 to 1964 to accept basin overflow. During 1962-1963, the concentrations of radionuclides in basin water had increased significantly and an ion-exchange bed cleanup system was installed in December 1963; however, the effluent from that bed was also disposed of via the pit until 1966.

In those days the guidelines for discharge were 100 times that for a controlled area value for radionuclides with half-lives greater than 30 days; these guidelines were provided in ID Appendix 0510. Today, these guidelines have been revised and provide more restrictive regulations.

Since 1966 no contaminated water has been released to the environment from the fuel storage basin, so as to conform to new guidelines. Instead, the basin overflow has been routed to the waste processing building for evaporation.

After abandonment of the pit, a new building was erected on the site as an extension of the existing fuel storage basin building, connecting with it and opening on one end to it. There is no quantitative information concerning the fraction of total disposed nuclides that were removed with the contaminated earth during excavation for the new building, but it was certainly considerably less than the total inventory earlier disposed of to the ground.

X.17.77 Comment

"The final statement should address why other accidental releases (to the ground) at ICPP (see pages B-2 through B-5) weren't considered in the ICPP impacts on water resources (pages III-81 through III-88). Also, what effect has the accidental release of long-lived transuranics to the injection well or seepage ponds had on groundwater quality?"

Response

The discussion in Section III.B.3 describes the existing impact on underground water resources, regardless of whether radionuclide releases were accidental or intentional. The discussion presents available information on this subject.

Plutonium-238, -239, and -240 have only recently been detected in the Snake River Plain aquifer in the vicinity of the ICPP disposal well. Plutonium has been detected in the aquifer up to 740 ft down gradient from the disposal well. Mean concentrations of 0.65×10^{-11} $\mu\text{Ci/ml}$ plutonium-238 and 0.24×10^{-11} $\mu\text{Ci/ml}$ of plutonium-239 and -240 have been identified in the aquifer at this point. These concentration values are about 2 million times lower than federal and State of Idaho concentration guides for drinking water used continuously by the public. This information is included in Section III.B.3.

X.17 COMMENT LETTER (Continued)

X.17.78 Comment

"On page III-71, the ERDA policy for low-level waste discharge or burial lacks the critical element of time during which a person should not be exposed. Thus, decisions which are adequate over a short time period may be lacking in the long-term. Similarly, the policy statement on page III-93 indicates that dilution and dispersion are relied upon. The final statement should address these policies and their relationship to the potable water contamination mentioned on pages III-106 and III-107."

Response

There is no substantial evidence of potential contamination by migration of radioactive wastes from buried materials to the Snake River Plain aquifer. In fact, recent studies of soil samples taken immediately below materials buried 13 years ago at RWMC show that waste nuclides have migrated (in significant quantities) only a few inches from the buried wastes. Core drilling and sampling of materials down to ~240 ft below buried wastes have also indicated no detectable migration. Further, sampling of the aquifer water itself reveals no detectable contamination from buried wastes.

With respect to contamination of the aquifer by liquid wastes injected directly into it, ERDA policy requires that waste nuclide concentrations be below acceptable drinking water quality standards. The ERDA policy controlling liquid waste releases is found in ERDA Manual 0524 where maximum concentrations of permitted waste isotopes are listed in Annex A for both controlled and uncontrolled areas. These maximum permitted concentrations (as shown in the revision of ERDAM-0524 of 4-8-75) are consistent with and based on NCRP Report Number 39. The values assume 168 hours of exposure per week and take into account long-term (many years) exposures.

The statement on dilution and dispersion is not intended to imply that dilution and dispersion are relied upon to bring waste nuclide concentrations down to acceptable levels. Wastes at the point of injection into the aquifer at ICPP already are below the concentration guide levels of ERDAM-0524. The statement was only included to indicate that further dilution occurs through additional dilution and dispersion.

X.17.79 Comment

"At the ICPP (page II-118), low volume highly concentrated wastes from the Service Building are mixed with the low-level radioactive wastes and are discharged to the disposal well. This concentrated waste stream is in the order of 5.7 million gallons per year. The final statement should discuss the alternative of using surface ponding of this small volume of highly concentrated chemical waste. A lined pond of a few acres in area should be adequate to eliminate any recharge to the aquifer from this source. Administrator's Decision Statement No. 5 (F. R. Vol. 39, No. 69, page 12922-23, April 9, 1974) provides EPA's policy on subsurface placement of fluids. The discharge of chemical wastes directly into an aquifer when there are reasonable alternatives is in conflict with EPA policy."

Response

The advantages and disadvantages of discharging liquid effluent to a surface pond in lieu of well disposal are discussed in Section V of the statement. ERDA and its contractor at ICPP are presently considering this alternative. The proposed EPA regulation (40 CFR 145) and any forthcoming state underground injection control program will certainly influence future liquid waste disposal practices.

X.17 COMMENT LETTER (Continued)

X.17.80 Comment

"The draft statement (pages I-12-I-14) considers only the actual land area used for waste management structures and disposal sites as the land commitment. A far greater amount is involved when the subsurface area or volume of contaminated soil, rock, and water is properly included. It is EPA's opinion that the statement on page I-16 'with the exception of those small areas dedicated to waste management . . .' does not consider the many future uses which are denied because of wastes in the aquifer or unsaturated zone, and that this area is greater than 210 acres. For example, irrigation and resulting return flows might seriously, adversely affect the retention of sorbed radionuclides. A hint of this larger commitment can be found on pages III-2 and III-5 where it is inferred that public use of INEL land may not be realistic. Therefore, we believe the final statement should expand on the larger commitment."

Response

The long-term land commitment is discussed in appropriate parts of Section III and summarized in Section I of the statement. The disposal pond at TRA is the major source of liquid contamination released to surface ponds. The statement indicates the pond area at TRA is less than 6.5 acres (actually, the pond itself is about 4.0 acres). Therefore, considering a buffer zone around the periphery of the pond, it is estimated that about 40 acres would be committed at this site. The four acres at NRF and buffer zone (total 12 acres) represent 52 acres of committed land used for seepage ponds. The rest of the ponds only receive very low-level activity which could be removed or backfilled and does not represent a long-term commitment. A land commitment of 52 acres from these two ponds seems reasonable in light of the vast lands available at INEL. If there is sufficient future pressure to put INEL land into production, these same pressures would result in monitoring, decontamination, and appropriate use of the land (within safety constraints) as close to the abandoned ponds as possible. The aquifer commitment is discussed in Section III.B.3 and VI and is not considered a long-term commitment.

X.17.81 Comment

"The section on solid waste states that the total land area currently committed to burial or storage of solid radioactivity contaminated waste is about 125 acres (page III-105). This is inconsistent with statements made elsewhere, e.g., page III-104, 158 acres; page I-14, 210 acres. Furthermore, the seepage basin and evaporation ponds areas underlain by soil/rock columns containing sorbed or otherwise retained radionuclides are, in effect, burial grounds. These are not included in this total. The final statement should further define and clarify these numbers."

Response

The 125 acres was an error and has been changed to 158 acres. The 210 acres discussed in the Summary (Section I) includes surface ponds and solid waste disposal and storage areas.

X.17.82 Comment

"On page III-75, it is stated that land commitment for injection wells is confined to the area occupied by the well head and feeder pipeline(s). It is EPA's opinion that although the degree of contamination or the depths vary from those associated with seepage ponds, there is no difference in principle, i.e., contamination of the resource and denial to at least some uses for a period extending into the future. Therefore, we feel the final statement should address this concern."

Response

The surface land commitment for injection wells is confined to the area occupied by the well head and feeder pipelines as indicated in the statement. The water resource commitment is

X.17 COMMENT LETTER (Continued)

Response (Continued)

evaluated in Section III.B.3 where all available information on this subject is given. Based on the low level of contaminants introduced into the aquifer (lower than levels permitted for drinking water), it is difficult to project denial of this resource for an extended period.

X.17.83 Comment

"Considering the low annual precipitation (8.5 inches) and abundance of groundwater supply the final statement should address an alternative waste management scheme of incorporating more evaporation and less seepage/injection."

Response

As noted in several responses to preceding comments, there is an active site-wide program at INEL directed toward drastic reductions in the use of seepage ponds and injection wells. A major project (extending through FY-1981) at TRA will, when completed, eliminate the use of the TRA seepage ponds. The shallow well at PBF for disposal of nonradioactive chemical waste is expected to be replaced by an evaporation pond. A similar evaporation pond is projected at TAN. Appendix E discusses the modifications underway or implemented.

X.17.84 Comment

"The waste disposal practices at INEL, as indicated in the draft statement, are such that the waste water discharges may be in violation of the intent of the EPA Proposed Regulations for State Underground Injection Control Programs published in the Federal Register on August 31, 1976. The Safe Drinking Water Act (PL 93-523) provides EPA with authority that may affect the ERDA operations at INEL. Part C requires EPA to develop regulations for state programs to control underground injection of wastes by well injection. The states, in turn, are charged with developing an acceptable control program. These regulations will apply to injection wells at federal facilities unless they are waived by the EPA administrator upon the request of the Secretary of Defense and upon a determination by the President that the requested waiver is necessary in the interest of national security [SDWA 1447 (b)]. This legislation will influence federal agencies to modify considerably their injection well practices as regards to the dilution of chemical wastes in cooling water and their subsequent injection into an aquifer. The approach that an aquifer can be degraded until drinking water standards are exceeded before contamination occurs is contrary to the precepts of the Safe Drinking Water Act. The final statement should include a discussion on these regulations and how they will be handled by INEL."

Response

ERDA is fully aware of the proposal to delegate control of injection wells to state authorities. Depending on what regulations the State of Idaho imposes, ERDA will attempt to comply with them to the fullest practicable extent. As noted in numerous places in preceding comments, the use of most injection wells at INEL is being phased out and the wells replaced with, in some cases, evaporation ponds. In other cases, additional facilities for treatment of waste water are being installed in order to (a) permit recycle of waste water and thus reduce volumes of disposed waste, and (b) lower the concentrations of pollutants to meet proposed EPA requirements. Of highest concern is the injection well at ICPP. The principal pollutant of the aquifer from this well is tritium. If the tritium concentrations of injected waste will be above the levels permitted by proposed regulations a drastic change in ICPP process may be required such as addition of the head-end voloxidation process to remove tritium from fuel prior to introduction to waste streams.

X.17 COMMENT LETTER (Continued)

X.17.85 Comment

"In EPA's opinion, the practice of waste disposal via ponds and wells in areas up gradient from supply wells is contradictory to the as-low-as-reasonably-achievable (ALARA) concept despite the fact that water quality meets drinking water guidelines for radioactivity. The final statement should address this concern."

Response

As stated in responses to several earlier comments the use of disposal ponds and some wells is being discontinued at INEL. However, it must be recognized that any waste water entering the Snake River Plain aquifer will always be up gradient from some supply of drinking water somewhere. The best thing that can be done to avoid this is either to completely cease addition of waste water to the aquifer, or to pretreat the waste water so that it more than meets standards for drinking water quality at the point of entry into the aquifer, recognizing that there may always be minute and insignificant quantities still present. This latter alternative would represent the "as-low-as-reasonably-achievable" concept. It must be recognized that there are always some levels of contaminants in waste water which meet standard requirements but below which, contaminant removal is not reasonable.

X.17.86 Comment

"On page IV-2, the tritium concentrations in the nearest downgradient production well (CFA) are calculated to result in an annual radiological dose commitment to onsite personnel of 4.0 millirem. If future circumstances of population growth or use of the Snake River Plain aquifer require use of this production well as a community water supply system, then EPA drinking water regulations concerning radionuclide maximum contaminant levels could be exceeded. The regulations published in July 1976 propose limits effective June 24, 1977 on the dose from manmade sources at four millirem per year for organs of the body or the total body of individuals served by the water supply. The INEL well waters at CFA are now at the maximum containment level and future discharges of tritium should be reduced as low as reasonably achievable to permit decay from the fully contaminated state. Therefore, the final statement should discuss the radiological doses received due to tritium in drinking water and should compare this annual dose commitment of four millirem with the dose standard in the Interim Primary Drinking Water Regulations promulgated by EPA under the Safe Drinking Water Act. Alternate well water sources at different locations on the site may be available and their use should be discussed in the final statement."

Response

The proposed EPA limits of 4 mrem per year whole body radiation might require one or the other of two solutions to the problem of the low level tritium in the drinking water supply at CFA. Either the main source of tritium (ICPP) would have to lower the tritium concentrations in its effluent, or drinking and culinary water for CFA would have to be brought in from supplies other than CFA wells. The latter solution would entail trucking or piping water. Another possible alternative would be complete relocation of the CFA facilities so that they would be up gradient from ICPP. These various alternatives will be addressed when appropriate.

X.17.87 Comment

"The document makes reference to specific standards, ERDA Manual Chapter 0511 and 0524, that regulate radioactive waste disposal at ERDA installations. Since many of the nuclear reactor facilities under test at the Idaho Engineering Laboratory are related to the development or testing of technology for electric power production, the comparison of Appendix I in 10 CFR 50 and the proposed standards of EPA concerned with long-lived radionuclides of the uranium fuel cycle (40 FR 23420) should be discussed in the final statement, in relation to the continued operation of the Idaho Site and the subsequent population dose levels."

X.17 COMMENT LETTER (Continued)

Response

ERDA facilities operate under the rules, regulations, and standards prescribed in the various ERDA Manual chapters; they are not licensed for operation as are commercial facilities, even though more or less related to commercial technology for electrical energy production. A discussion of any differences between the safety requirements for ERDA facility operations and the safety requirements for commercial facility operations is outside of the scope of this document.

X.17.88 Comment

"A number of alternatives are considered relative to current waste management practice and operations at INEL. In our opinion, this chapter does not present the various alternatives in a uniform manner to determine which alternatives are most realistic or feasible in comparison to the others. The costs of the suggested alternatives are not uniformly presented - nor are any potential benefits identified other than a statement on page V-3 that that general alternative of shutting down all waste systems would guarantee zero emission. The final statement should discuss each of the disposal or discharge facilities described in Chapter II and evaluate them in comparison with the alternative recommended by INEL."

Response

Section V has been reworked to include a more extensive discussion of certain options.

X.17.89 Comment

"The draft statement indicates that shutting down all waste systems would guarantee zero emission (page V-3). We feel this is misleading. Perhaps emissions from operating facilities would be eliminated, but the potential for release of radioactive materials to the environment would still exist from previously generated wastes. This should be mentioned in the final statement."

Response

It is agreed that if all waste generating facilities were shut down that there would still be some (though small) potential for release of radioactive materials to the environment from previously generated wastes. This is clarified in the final statement.

X.17.90 Comment

"In Section V-A.2.b, the alternative of terminating waste handling operations and providing surveillance of existing stored and previously disposed waste is considered. The statement is made that this alternative would require the continued sampling, monitoring, and surveillance of waste locations, which are estimated to cost approximately \$200,000 annually. In EPA's opinion, this section does not completely address the true costs of the above alternative. The final statement should consider the additional initial costs for engineering and excavation associated with seepage and burial site closing, the problem of long-term care and maintenance associated with this alternative and the costs, care requirements, and duration of care and surveillance required."

Response

The annual estimated cost of \$200,000 is for the sampling, monitoring, and surveillance efforts only. Additional initial costs would be required to prepare the waste facilities for perpetual surveillance. This option is discussed more completely in the revised Section V.

X.17 COMMENT LETTER (Continued)

X.17.91 Comment

"In Section V-A.3, the alternative of transferring waste offsite is discussed but no cost estimate is provided for this alternative. The final statement should discuss this."

Response

Estimation of the costs of transferring INEL generated wastes offsite cannot be made at this time. The safety criteria for such operations have not yet been published by NRC which has the cognizance and authority over radioactive waste shipping, packaging etc. It also seems quite obvious that the hazards of some wastes will be low enough that their transport offsite would not be cost-effective. But for wastes requiring offsite shipment, there are presently insufficient criteria to use in estimating transfer costs. However two documents under preparation, "Alternative Studies for TRU Wastes and Calcined Wastes" will address this subject. These documents are identified in the Foreword of the final statement.

X.17.92 Comment

"Section IX.2.c discusses costs of solid radioactive waste disposal options. On page IX-14, cost estimates are given for encapsulation and engineered storage and combustion and engineered storage as \$27/ft³ and \$12/ft³, respectively, for routine solid radioactive wastes. These costs are compared to the current method of disposal at \$1.10/ft³. The final statement should indicate the time duration for which the estimates for the engineered storage options are made and the basis from which the cost estimates are determined. The cost estimates should be documented by reference to an engineered storage facility design, if possible. These estimates should include identifying future costs for long-term waste management options which then could be compared with present costs."

Response

INEL wastes closely parallel wastes from the commercial fuel cycle. ERDA has recently published (ERDA-76-43) a five volume report, "Alternatives for Managing Wastes From Reactors and Post Fission Operations in the LWR Fuel Cycle". Reference is made to that report for the sizeable quantity of information requested. A companion study to the information reported in ERDA-76-43 is now in progress and will address the environmental impacts of the various alternatives identified in ERDA-76-43. This second study addresses storage facility designs, costs, and other factors. It should be noted that the costs quoted in Section IX are estimates only. Better information will be provided in the report for the second study mentioned above.

X.17.93 Comment

"The final statement should include an estimate of projected land commitment. While the draft statement currently estimates that only about 210 acres are permanently committed, this can be expected to increase with time as future wastes are generated. Additional commitments may be required as major facilities are decommissioned."

Response

The 210 acres quoted as permanently committed do not include potentially decommissioned facilities. If some of the present facilities were to be torn down and decontaminated, an additional few acres might be assigned "permanent commitment" depending upon complete facility disposal. For facilities built in the future, the environmental impact statement for each will address the appropriate area assigned as "permanently committed."

X.17 COMMENT LETTER (Continued)

Response (Continued)

There are no current plans or projections for increases in the size of waste management sites. If this is required in the future, appropriate environmental analyses will be prepared.

X.17.94 Comment

"The final statement should include the cost estimates for the waste handling processes, where possible, in planning future waste disposal site controls."

Response

The subject of including cost estimates is treated in the response to the second preceding comment. The response explains why detailed cost estimates for various waste handling processes have not been included in the statement; it also refers the reader to a forthcoming report. It should be noted that any future waste handling facilities at INEL will require their own environmental analyses including cost-benefit analyses.

X.17.95 Comment

"It is not clear how the predicted concentrations of nitrogen oxides, carbon monoxide, and particulates, listed in Table III-XV, were determined, as the averaging times are not indicated. The final statement should contain a description of the methodologies and assumptions used in generating these figures and should indicate the time intervals used with each estimate."

Response

The averaging time for estimated concentrations of contaminants at the INEL boundary resulting from waste calcination is one year. This is footnoted in Table III-15. The concentrations were determined at the nearest site boundary using mean annual meteorological conditions for releases from the 250-ft-high ICPP stack. The annual atmospheric dispersion coefficient was obtained from measured data at INEL and is explained in Appendix D.

X.18 COMMENT LETTER, U. S. Department of the Interior,
Washington, D. C. 20240

X.18.1 Comment

"The draft statement lacks information concerning environmental hazards of the components of the radioactive wastes. To adequately characterize environmental effects, we recommend the final statement include a full discussion of the toxicity of released radionuclides, outside of specific dose calculations for specific human exposures. The latter are not sufficient to describe ecological effects of each species of released radionuclides. For example, on page III-61 of the draft statement it is stated that iodine-129 is estimated to have been released at an average rate of 0.1 Ci per year. Compared to the millions of curies of other gases released each year, this quantity might seem small; however, iodine-129 is extremely active biologically and has a half-life of 17 million years. Similarly, there is no mention of the characteristics that would make plutonium and other long-lived transuranic components of the waste an unprecedented environmental hazard."

Response

It is true that several of the longer-lived radioisotopes have higher toxic characteristics than other radioisotopes. However, a complete description of pathways and toxicity of released radionuclides is beyond the scope of the environmental statement. This type of information is available in public literature and it is believed inappropriate to expand on this vast subject in the environmental statement.

X.18 COMMENT LETTER (Continued)

Response (Continued)

The direct and indirect environmental impacts on man from all radionuclides released in various waste management operations are presented on a common basis (mrem) in order that direct comparisons can be made. In addition, in Section III.B.9, a discussion and data are presented showing the health effects of projected release of tritium, krypton-85, iodine-129, and plutonium-239 from INEL facilities to the year 2020.

X.18.2 Comment

"The narrative describing impact of the proposed action is directed mostly to impact on man rather than impact on the total environment. We believe the indirect effect on man resulting from changes in the natural environment should also be considered in the final statement."

Response

Section III of the statement describes not only the impact on human activity but the impact on biota, on land, on air, and on water resources. These latter impacts provide indirect impacts on man which were evaluated and described in the document.

X.18.3 Comment

"Throughout the draft statement, geologic conditions are discussed in highly generalized terms that are not adequate for an evaluation of the environmental impact of the waste management operations. For example, the geologic information shown in Figures II-34, II-37, II-60, and II-68 in the draft statement makes reference to 'sediments' or to 'surficial deposits,' but little information is provided on the character or thickness of these unconsolidated materials. We recommend that the final statement should provide a complete description of subsurface material beneath the seepage ponds and solid waste burial grounds, since the long-term containment of the radioactive waste is dependent upon the properties of the underlying material. For example, the draft statement indicates on page II-285 that 'the fraction of the soil less than 2mm in size has the capacity to sorb radioactive ions,' but the prevalence of this size fraction in soils beneath the disposal sites is not discussed. We recommend that the final statement provide a more comprehensive analysis and evaluation of the probable magnitude of ion-exchange and sorption on the basis of sediment distribution. This evaluation should consider the significance of the smaller proportion of sediments found within the basalt section in some parts of INEL such as the southeast and south central areas as compared to the areas of Big Lost River and the playas. We believe that the information in the final statement should be sufficient to determine whether or not nuclear contaminants will eventually move beyond the boundaries of the INEL. We recommend that the final statement should provide more adequate information on the justification for storing these wastes above such a large aquifer which is vital to grazing, irrigation, municipal and industrial use in southern Idaho."

Response

The subsurface materials at the Test Reactor Area (TRA) can be divided into three segments; the surficial alluvial sediments, the main perched water body and the segment below the perched water and the Snake River Plain aquifer. The character and thickness of these materials is discussed below.

The surface layer of alluvial sediments from the Big Lost River is composed of a heterogeneous mixture of clays, silts, sands, and gravels. Generally it contains 50 to 80% gravel (>2-mm grain diameter), 15 to 40% sand (0.0625- to 2.0-mm grain diameter), 2 to 10% silt (0.004- to 0.0625-mm grain diameter), and 1 to 5% clay (<0.004-mm diameter). The thickness of the surface alluvium at the TRA ranges from 35 to 65 ft and averages about 50 ft.

X.18 COMMENT LETTER (Continued)

Response (Continued)

The main perched water body at TRA occupies a sequence of basalt layers lying between the surface alluvial sediments and the main perching layer at a depth of about 140 ft. Hydraulic conductivity of basalts in the INEL area is generally very high and is normally higher horizontally than vertically. The effective porosity of INEL basalts is probably between 5 and 15% although it has not been measured in a large field test. Generally, an average value near 10% appears reasonable.

A lower segment of the TRA subsurface system comprises all strata between the major perched body and the water table of the Snake River Plain aquifer. This sequence is about 300 ft thick and is made up of approximately 75 ft of major sediment layers; about 220 ft of basalt; and about 5 ft of minor sediment layers. The upper perching sedimentary zone is composed of one thick layer or two thin layers which together make up about 60 ft of sediments immediately beneath the perched water in the basalt. There are generally at least two additional thinner sedimentary beds beneath the thick perching layers. The sedimentary layers have generally been observed to be mixed clays, silts, sands, and gravels and are considerably finer grained, on the average, than the surface alluvial sandy gravel layer. Grain size analysis data from similar subsurface sedimentary layers have indicated that most are composed of more than 50% silt and clay sized particles.

At RWMC, several sedimentary strata were found interbedded between much thicker strata of basalt. Both rock types are stratified and more or less horizontal. Below RWMC, the sediments comprise about 5% of the (vertical) stratigraphic column between the surface and the water table. They are composed of unconsolidated clay, silt, sand, and gravel. Below the surficial sedimentary layer, two additional principal sedimentary layers were encountered. Based on their approximate depth, they are referred to as the "110-ft" and "240-ft" sedimentary layers.

At RWMC the basaltic bedrock is overlain with a veneer of sediments. These sediments range from 3 to 25 ft thick and average about 15 ft thick. The elevation of the bedrock surface and the thickness of the overlying surficial sediments are highly irregular.

The thickness of the 110-ft sedimentary bed ranges from a maximum of 26 ft to less than 1 ft. The thickness averages 13 ft.

The thickness of the 240-ft sedimentary layer ranges from a maximum of 32 ft to a minimum of 4 ft. In the central part of the RWMC, the 240-ft sedimentary zones range from 15 to 32 ft thick. Their average thickness beneath the RWMC is about 14 ft. Over much of the area of the RWMC there is a difference in the distributions of the thick and thin areas from one horizon to the other; where one is thick, the other is thin.

Two additional sedimentary zones were found at greater depth but still above the water table. Two zones, 17 and 10 ft thick, were found in one observation well. In each of the other three deep wells, zones 1 to 7 ft in thickness were encountered.

The aggregate thickness of the 110- and 240-ft sedimentary layers is an important characteristic to be considered in evaluating their effectiveness for retarding downward water or nuclide migration. The greatest combined thickness is 52.5 ft. A minimum thickness of 20 ft is at the northeast corner of RWMC. The average combined thickness of the two sedimentary beds beneath the RWMC is 33 ft.

The sediments sampled are unconsolidated clay, silt, sand, and gravel, light tan to orange in color. Grains ranged from clay size to pebbles as large as 1.5 in. in diameter. Grain size distributions are shown in the table.

X.18 COMMENT LETTER (Continued)

Response (Continued)

CLAY AND GRAIN SIZE OF SEDIMENTS BENEATH RWMC

	<u>Surficial sediments</u>	<u>110-foot (34-m) layer</u>	<u>240-foot (73-m) layer</u>	<u>Deeper layers</u>
Number of samples	8	12	24	2
Mean clay content, percent	32.7	22	18.6	8.3
Median grain size, mm	0.021	0.156	0.037	0.043

The coarser particles are well rounded and include quartz, quartzite, and various metamorphic and silicious volcanic rock types which were brought in by streams flowing from the mountainous region to the west of the Snake River Plain.

Of the three most extensive sedimentary strata, the surficial sediments and the 110-ft sedimentary layer have the greatest proportion of gravel. The surficial sedimentary layer contains gravel beds between depths of 2.5 to 9 ft in one well and 7.5 to 18.5 ft in another well. The 110-ft sedimentary layer contains gravel between depths of 100.5 to 110 ft in one well.

The mean clay content of 46 analyses of samples from sedimentary beds was 22% and the range was 5 to 52%. The median grain size of all the analyses was 0.066 mm.

The relatively thin sedimentary strata interbedded with basalt were deposited by wind and water on basaltic land surfaces during periods of local volcanic quiescence. The basalt surfaces are generally permeable and topographically irregular with a poorly defined drainage system. Numerous closed depressions with relatively few through-flowing streams would be expected. These sediments were derived primarily from igneous, sedimentary, or metamorphic rocks outside the Snake River Plain.

The stream deposited surface sediments are identifiable by their content of sand and gravel particles which are too large for wind transport, by their rounded shapes produced by stream abrasion, and by their mineralogy which may indicate a distant source. The greatest thickness of stream deposited material found was 11 ft immediately above bedrock.

The distribution of gravel through RWMC from west to east suggests that stream channels brought gravel into the area from the west. The gravels may have been transported during unusually large floods. These gravel filled channels coincide with the location of the lowest part of the present land surface. These stream deposits interfinger with windborne deposits.

The windborne sediments have been deposited in RWMC and on the leeward slope of the approximately 30-ft-high ridge to the west and southwest of RWMC. The slope to the northeast of RWMC has practically no surficial sediment. These deposits generally consist of clay, silt, and fine sand. Some small lenses of lacustrine clays and silts are also apparent in RWMC sediments.

In addition to the stratified sediments, other sediments line or fill some fractures and vesicles in the basalts. This material filtered downward from the land surfaces by gravity and water transport through interconnected openings in the basalt.

X.18 COMMENT LETTER (Continued)

Response (Continued)

In an ongoing program started in 1975 and continuing into 1977, core drilling at RWMC has shown that there are actually no detectable radionuclides present in the sedimentary beds underlying RWMC. These studies are referenced in the final statement. They provide strong evidence that RWMC waste storage has not contaminated the Snake River aquifer or the sediment beds lying above it, which would be detectably contaminated if nuclides from buried wastes had leached out and migrated downward.

Digital modeling techniques have been applied successfully to the analysis of the complex waste-transport mechanism associated with the waste injected directly to the aquifer at the TRA-ICPP Complex. The model includes the effects of convective transport, flow divergence, two-dimensional hydraulic dispersion, radioactive decay, and reversible linear sorption. The modeling results indicate that hydraulic dispersion is a significant influence. The model has been used to estimate future waste migration patterns for varied assumed hydrological and waste conditions up through the year 2000. The hydraulic effects of recharge from the Big Lost River have an important (but not predominant) influence on the simulated future migration patterns. For the assumed conditions, the model indicates that detectable concentrations of waste chloride and tritium could move as much as 16 to 17 mi down gradient from the original discharge points by the year 2000. This is about 9 mi south of the INEL boundary. However, the model shows strontium-90 moving only 2 to 3 mi down gradient in the same time.

Caution must be exercised in interpreting future projections. The longer the projection, the more subject to error it is. One source of error is vertical dispersion. For longer-term projections (perhaps 25 years), vertical dispersion may be very significant. The actual extent and concentration of a plume would probably be less than those shown by the model projections. There are also other factors which limit the accuracy of future projections. These include errors in estimated or fitted distribution of transmissivity, porosity, distribution coefficients, and dispersivities. In addition, the parameters fitted for the historically observed waste plume areas may not apply as well to the areas the plumes will occupy in the future. Large increases in the future withdrawals of water from the aquifer could change its hydraulics significantly from those assumed. Ultimate validity of the model will be shown only after many years when the presently projected future migration patterns can be compared to actual observed patterns.

X.18.4 Comment

"We recommend that the final statement should consider the probable beneficial and adverse impacts of very rapid infiltration during periods of high stream discharge in evaluating both solid waste disposal and storage, and dilution of wastes already in the groundwater reservoir.

We find that the draft statement does not adequately discuss the possibility of flooding of the waste burial grounds at INEL. We believe that the location of the waste burial grounds should be shown on a detailed map in the final statement in relation to the local drainage and/or the Big Lost River flood plain. A recent report by the U.S. Geological Survey shows the burial ground to be in a depression surrounded on three sides by low hills. This suggests that the flooding from local precipitation and rapid snowmelt, noted in the draft statement for 1962 and 1969, could be a persistent problem. The burial ground is located on the flood plain of the Big Lost River, about two miles from its present channel, but about 40 feet below the channel elevation. The report cited above mentions evidence suggesting that within the recent geologic past, floods of the Big Lost River flowed through the basin in which the burial grounds are located. We recommend that this information be included in the final statement, in a full evaluation of the long-term flood potential of the burial ground. Other facilities, in particular the ICPP, also appear to be located on the flood plain. An evaluation of the potential of flooding this and other potentially affected facilities should also be included in the final statement."

X.18 COMMENT LETTER (Continued)

Response

Rapid infiltration from high flows of the Big Lost River moves down to the Snake River Plain aquifer and dilutes any wastes present in the aquifer. This recharge also displaces the waste plumes eastward. In general, recharge from the Big Lost River does reduce the waste solute concentration in the aquifer near the river, but the overall change in waste movement and concentrations is not extensive in areas away from the river.

Potential long-term flooding of RWMC and other INEL facilities is currently the subject of an extensive study to be completed this year. It will include the possible effects of a 300-year flood due to snow run-off and precipitation, as well as catastrophic failure of the Mackay Dam. However, information will not be available in time to be included in this statement.

X.18.5 Comment

"We believe that there is inadequate documentation for the assumption on page II-124 that 'Climatology and hydrology of the area preclude major flooding of the facility site in the current geologic era.' A Geological Survey report is cited on page II-294 in the draft statement as a 'detailed analysis . . . on the probability and potential effects of rare and catastrophic floods on the Big Lost River in relationship to the INEL.' However, we understand that the report was limited to a determination of the probability of snowmelt floods on the Big Lost River exceeding the capacity of the INEL diversion dam, the associated diversion channel, and the spreading ground dikes. The report concluded that the system existing in 1971 would be overtopped by snowmelt floods of magnitudes exceeding a 55-year frequency, and that by doubling the diversion channel capacity, floods of a magnitude corresponding to a 300-year frequency could be contained. Contrary to the draft statement, the report by the Geological Survey did not investigate rare and catastrophic floods, such as a probably maximum flood based on the most extreme meteorologic and hydrologic conditions to be expected in this region or failure of Mackay Dam. The report states that failure of Mackay Dam may be hypothesized for floods of a recurrence interval not much greater than 300 years; that results have not been investigated; and that this factor should be considered in plans for improving the INEL flood-control system.

It should also be emphasized that this report did not investigate effects of floods on any INEL facilities other than the diversion dam, diversion channel, and spreading ground dikes.

We strongly recommend that the section in the final statement concerning hydrologic impact should more accurately reflect the analyses of flood potential contained in the Geological Survey report cited. We also recommend that the final statement investigate rare and catastrophic floods and consider plans for improvement of the INEL flood control system.

Since the long-term flood potential of the present solid waste disposal site is not fully described in the draft statement, an adequate comparison of alternative locations for the burial ground and the transuranic storage area cannot be made. We recommend that the final statement include these considerations to facilitate a complete evaluation of the proposed solid waste disposal site and its alternatives. In addition, we believe that the final statement should consider relocation of the burial area to higher altitudes not subject to flooding."

Response

The quoted sentence has been deleted from the final statement. It is correct that the report (Reference 71) cited did not include a study of what is probably the maximum credible flooding at INEL; that is, simultaneous failure of the Mackay Dam and the rare, but extreme 300-year flood. An extensive study of this possibility (as well as lesser flooding potentials) is currently in progress but will not be completed until late 1977 and cannot be cited in this

X.18 COMMENT LETTER (Continued)

Response (Continued)

statement. However, based upon the results to be presented in the report, an evaluation can be made of any necessary measures required to protect RWMC buried materials or to protect other INEL facilities.

X.18.6 Comment

"Results from a mathematical model showing strontium and cesium attenuated to insignificant levels 100 and 300 years after migration from the burial grounds are discussed on page III-105 to III-106 and are attributed to an excerpted report that was to be published by the Geological Survey after the draft statement. This report has now been published, but we believe it does not contain the results attributed to it in the draft statement. These results were from an earlier draft and were based on a set of assumptions and simple arithmetic calculations, not mathematical models. In fact, we understand that these results were considered to be so highly speculative because of the lack of documentation for the assumptions, that the results were not published in the Geological Survey's final report. Also on page III-107, the draft statement concluded from the unpublished version of the report that it seems likely that samples showing radionuclides to have migrated below the burial grounds were, in actuality, contaminated by surface sources. We believe this implies that the downward migration of radionuclides was not shown by the Geological Survey's report and thus, differs from the conclusion reached in it. Inadvertent contamination of samples was a distinct possibility considered in great detail. However, in the published report the authors 'infer that some radionuclide constituents of the waste have migrated from the burial pits and trenches to the 100-foot (34-m) and the 240-foot (73-m) sediment-layers.' We strongly recommend that this section of the final statement should be reconciled with the data and analysis actually published in the finalized version of the Geological Survey report."

Response

This section (Section III.B.5) has been rewritten to clarify and include recent studies on the migration of radionuclides from RWMC.

X.18.7 Comment

"We believe that the discussion of archaeological resources in the draft statement is insufficient for compliance with the National Historic Preservation Act of 1966 and Executive Order 11593 'Protection and Enhancement of the Cultural Environment.' We recommend that the final statement should include a more extensive discussion of the cultural resources of the project area including a description of the sites, analyses of impacts upon them, and specific mitigation measures proposed."

Response

The discussion of archeological resources at INEL is limited due to apparent absence of any very significant resources. Only minor archeological exploration of INEL has been carried out, almost entirely by a mixed professional/amateur group from Idaho State University. This group, under permits issued (and renewed) by the Department of Interior, has conducted several summer programs - surveying, excavating and collecting archeological information and small artifacts (such as projectile points) from a few selected sites at INEL. No really significant resources, such as prehistoric ruins, have so far been uncovered. However, the entire INEL has not been carefully surveyed. Generally, INEL appears very barren, archeologically speaking.

Nonetheless, to protect any archeological resources that may exist on INEL, the Idaho Operations Office of ERDA, in complying with all appropriate federal regulations (such as those cited in the comment, plus others) has implemented a number of actions briefly summarized as follows:

X.18 COMMENT LETTER (Continued)

Response (Continued)

- (a) Announced to all employees and contractors that collection, without permit, of archeological items at INEL is prohibited by law.
- (b) In 1961 and 1962 assisted in issuance of permits by DOI for archeological surveys, excavations, and collections of archeological resources by Idaho State University. These permits have been renewed.
- (c) Erected signs at INEL warning against improper appropriation, excavation, injury to or destruction of ruins, monuments, or objects of antiquity.
- (d) Entered into an agreement with the National Park Service, through which NPS caused a survey to be made of a construction area at RWMC.
- (e) Stipulated in all construction contracts that if, in the course of excavations for structures, archeological resources are uncovered, the work will be stopped until appropriate evaluations are made. A complete file of correspondence and related information is available in the office of the Chief Counsel of the ERDA Idaho Operations Office in Idaho Falls. It is believed that ERDA has complied with all statutory and regulatory requests in the areas of cultural resource management at INEL.

X.18.8 Comment

"On page II-258 of the draft statement it is stated that the Experimental Breeder Reactor I is listed on the 'National Register of Historic Places.' Since this site is on the National Register, we believe that it is necessary to assess the impacts of the proposed action upon the site in consultation with the State Historic Preservation Officer and through application of the Criteria of Effect under 36 CFR, 800."

Response

The establishment of EBR-I as a national historic site has had little impact on the waste management program at INEL or vice versa. Prior to opening the EBR-I reactor building to the public, a thorough decontamination effort was completed. Residual sodium-potassium alloy formerly used as reactor coolant, was drained out, chemically reacted to form sodium and potassium hydroxides, the hydroxides evaporated to dryness, the reaction vessel sealed, and transferred to RWMC for subsurface disposal.

The roadway leading to the EBR-I site from the US-20-26 highway is open to the public. This same roadway serves truck traffic going to RWMC but shipments destined for that area present no problems to the general public. Shipments of waste are escorted by police vehicles in front of and behind the shipping truck, which itself presents minimal direct radiation hazards to tourist/motorists; the motorists present no significant hazards to the shipment truck.

Two years of access of EBR-I to the public to view and tour as a historic site have presented no problems. The National Park Service maintains a ranger on duty in the reactor building during the three months in summer in which the facility is open.

As far as impact of waste management operations is concerned, they have no detectable impact on the EBR-I historic site. The closest facility is RWMC and it is about 2 mi distant. RWMC releases no radioactivity material either solid, liquid, or gaseous (airborne) which can affect EBR-I in a significant way.

X.18 COMMENT LETTER (Continued)

X.18.9 Comment

"The total quantity of radioactivity in solid wastes disposed of at the burial grounds from 1952 and 1974 is presented in the draft statement on page II-226 as approximately 6 million curies. However, Table II-LIII identified radionuclide species for only those solid wastes buried in 1974. Since the total radioactivity in the solid wastes was very small in 1974 as compared to other years (Reference Table II-LV), and there was no indication that the 1974 waste composition was typical, the radionuclide species contained in the 6 million curies of waste remain unknown. Because presumably both short- and long-lived species are included, the total curies of waste does not adequately describe the wastes."

Response

The inclusion of the table identifying radionuclide species buried in the year 1974 was for the purpose of showing a typical "mix" of radioactive materials buried. It was not intended to imply that the year was typical with respect to the magnitude of the number of curies of waste buried. It should be noted that the annual Waste Information Management System (WMIS) reports contain summaries to date of all buried wastes at INEL, with corrections for decay of individual radionuclides shown. These provide a current and full picture of the buried waste at INEL. This report is referenced in the statement (Reference 8).

X.18.10 Comment

"The same lack of information applies to the discussion of ANLW high-level wastes in the draft statement on page II-233. However, on page III-107 the draft statement indicates that the activity of more than 9×10^6 curies in the wastes would be reduced to insignificant levels within 100 years. One constituent of these wastes, plutonium-239 with a half-life of 26,000 years, could not be significantly reduced in 100 years. We believe that without knowing the quantity of plutonium-239 and all other long-lived radionuclides in the over 9×10^6 curies of ANLW wastes, the statement concerning their decay to insignificance within 100 years cannot be substantiated (see page III-107). We recommend that the final statement identify the composition and half-lives of the radionuclides in both solid wastes and the ANLW high-level wastes in a single table so that the impact caused by long-term decay products can be readily assessed."

Response

Text changes are made in Section II.A.9.d to expand the description of ANL-W radioactive solid wastes.

X.18.11 Comment

"The accumulation of iodine-129 measured in antelope thyroids appears to be surprisingly high relative to the estimated release of 0.1 Ci per year. In the absence of any discussion of its mechanism of uptake and in view of the 17-million-year half-life of iodine-129, we assume that there is a cumulative effect in wildlife and that the thyroid concentrations will continue to rise. As the recorded concentrations already approach levels that would be considered on the order of the maximum permissible burden for human thyroids, it is likely that eventually these levels could become significant also for antelope. We recommend that this issue be fully considered in the final statement."

Response

The highest measured specific activity of iodine-129 in antelope thyroids would produce a dose of 68 mrad/year. (The maximum permissible thyroid dose for humans of an exposed population is 500 mrem/year). This is the highest thyroid sample found even after buildup of iodine-129

X.18 COMMENT LETTER (Continued)

Response (Continued)

from twenty years of plant operation. Man's thyroid and that of the antelope are not exactly comparable, nor does the level of iodine-129 in antelope indicate a corresponding level in man. Since man would receive iodine-129 through a less direct pathway than the antelope would (from vegetation consumption), man's dose from iodine-129 is calculated to be, at most, 5% of the maximum permissible thyroid dose for the general human population. Assumptions used to calculate this dose are stated in Appendix D. Studies currently in progress are seeking to quantify iodine-129 levels in antelope, other animal indicators, and the environment. Such studies have not progressed sufficiently to make any statements about trends or about whether the previous samples are representative.

X.18.12 Comment

"The section on alternatives indicates that iodine release could essentially be eliminated at a cost of \$400,000 but it is not indicated in the draft statement whether or not this alternative is being actively considered. We recommend that the final statement should supply a serious consideration of this alternative in view of the measured levels of iodine-129 found in antelope thyroids."

Response

The technology of controlling iodine release (by absorption of the iodine present in plant effluents on suitable absorbers such as treated charcoals or silver zeolite) is under active development. However, because INEL boundary levels of iodine present no significant hazards, consideration has not been given to application of this technology at ICPP, the only INEL facility releasing iodine to the atmosphere in measurable quantities.

X.18.13 Comment

"It is desirable that the impact of the proposed action on the natural environment should be clearly discussed in the final statement. Since INEL has been designated a national environmental research park to study environmental changes caused by man's activities, and develop information to assist in land use decisions, we suggest that additional ecological information be included in the final statement. The seral or climax status of the natural plant communities represented in the project area should be identified, along with present trends. It would be helpful if the home range of major animal species represented on the site, including antelope and sagegrouse, were mapped and their seasonal movement patterns identified. Likewise, the status of representative species lower on the food chain should be considered as part of the baseline information needed to interpret the status of the natural communities present. We understand that ecological studies are in progress, but we recommend that analyses completed to date should be incorporated into the final statement. Heavy grazing by domestic livestock could seriously alter and adversely affect the natural plant and animal communities present in the area, thus masking any impact from radiation and grossly reducing their value for research purposes. For example, certain plant species may be less tolerant to radiation exposure than others. Some species may also be less tolerant of grazing pressure, creating difficulties in data interpretation. We suggest that the elimination of grazing be considered to ensure that the environmental research project results are as accurate as possible."

Response

Several ecological studies are in progress at INEL but are not completed. The scope of these studies is reported in the 1975 Progress Report, Idaho National Engineering Laboratory Site Radioecology-Ecology Program, IDO-12080, which is referenced in Appendix E. The report covers radioecological and ecological studies being conducted on and around the National Environmental Research Park, but are not complete enough to include in the statement.

X.18 COMMENT LETTER (Continued)

X.18.14 Comment

"The discussion of the impact on the biota is divided into segments by type of specific action involved. Since it is the sum of the total action that will impact the environment, we believe that these impacts could be more effectively discussed in their overall context. The discussion in the draft-statement entitled 'Environmental Dose Commitment' relates specifically to man, rather than the overall environment. Consequently, it seems that in addition to viewing total effects of proposed action, there is a need to consider the impact of all radiation persisting over an extended time from all sources in the project area. We believe the impacts of radiation from the INEL project should be considered in addition to present and future radiation that would impact the overall environment from other sources."

Response

The comment suggests that the total impact of waste management operations be discussed in its overall context rather than in segments, by type of specification involved. Ideally, such a synthesis would be desirable, but to be complete and all-encompassing would entail evaluating each of the biotic systems at INEL, some of which are doubtless impacted to less than a measurable extent. It would also entail measurements extending over many more years than are feasible. Therefore, only the segments of highest and most important interest have been addressed, principally the impact on man. However, as noted (preceding comment), there is an extensive research program in progress, looking into many other facets of impact on biota.

The impacts of INEL supplied radiation versus radiation from other sources are in effect addressed, inasmuch as numerous comparisons are made of samples collected onsite with samples collected offsite where INEL influences are negligible. Extensions into the future, especially for offsite radiation sources, is not possible.

X.18.15 Comment

"We recommend that the impacts section in the final statement be expanded to include a worse case analysis of the effects of a human thyroid dose of about 21 mrem from iodine-129 consumed in meat from animals grazing at the highest point of radiation exposure (see page III-62 in the draft statement)."

Response

The effects of a human thyroid dose of 21 mrem resulting from consumption of 80 kg (176 lb) of meat from animals grazing at the highest point of radiation exposure is discussed in Section III.B.8.

X.18.16 Comment

"A good description of the impact of discharge of contaminated liquids into the lithosphere is presented in the draft statement on page III-80 to 93. However, the final statement could be improved by adding a description of the impact to a person eating several waterfowl containing the highest probable radionuclide concentrations."

Response

A description of the impact on a person eating waterfowl containing the highest probable radionuclide concentrations is presented in Section III.B.3.

X.18 COMMENT LETTER (Continued)

X.18.17 Comment

"Section II.C.10 and Appendix B omit any discussion of the current accidental releases from the TRA retention basin mentioned on page II-194 in the draft statement. Apparently the loss for the past several years has amounted to more than 10 percent of 15 to 20 million gallons per month. We recommend that the final statement indicate how great the increase in impact may be, as compared to that resulting from bypassing the retention pond and routing all low-level waste directly to the seepage pond. We suggest the final statement also should clarify whether such a bypass would be considered as a permanent practice."

Response

The effect of bypassing part of the waste water sent to the retention basin is minimal and not considered an accidental release. The concrete basin was originally built to provide for temporary holdup of waste water, to allow for decay of short-lived nuclides therein, before releasing that water to the seepage pond. After the original pond had been in use for some years, the characteristics of the material on the bottom of the pond changed and seepage of waste became progressively slower. Consequently, a second seepage pond was constructed, to operate in series with the first pond, which, by that time, was in effect functioning partly as a retention pond. Later a third pond was built.

Leakage of waste water from the retention basin, in effect "short-circuits" part of the waste which normally would exit via the basin and three ponds, and instead allows the water direct passage to the ground in relatively short time. Two shallow wells (30-35 feet deep) in the near vicinity of the basin exhibit direct correlation of their water levels with releases from the basin. When the basin is accepting waste water, the water level in those wells rises, indicating rather rapid transmission of the basin leakage water to this shallowmost perched body of water, thus allowing little time for short-lived nuclides to decay. The average residence time of water in this uppermost perched body of water is a few weeks; thus short-lived nuclides decay to insignificant levels before moving downward to a large body of perched water beneath, so that the uppermost body of perched water is itself providing a "retention-for-decay" function.

It should be noted that the TRA liquid waste upgrade program (discussed in Appendix E), now in its first phase of construction, will ultimately obviate the need for the retention basin and seepage ponds, since all waste water will either be recycled or sent to ICP for evaporation. Meanwhile, only very low-level wastes are being discharged to the seepage ponds.

X.18.18 Comment

"The possible alternative of transferring wastes away from the INEL site is rejected on page I-15 in the draft statement because 'This alternative would require the same commitment of lands and waste handling facilities at another location with the added risk and costs associated with transporting waste from INEL to the alternate location.' We believe that this disregards the present local potential hazards to water in the Snake Plain aquifer underlying the INEL and water in the rest of the Snake Plain. The final statement should fully discuss this potentially significant adverse impact on the Snake Plain aquifer, including adverse secondary effects to the economy and environment of that area. Further, we are not aware of a method to 'decontaminate' the regional aquifer once it has been contaminated."

Response

The comment reflects concern, expressed by others as well, that the wastes stored at INEL present a potential hazard to the Snake River Plain aquifer. ERDA has long shared this concern and has carried on for a number of years, an extensive core drilling and aquifer sampling program to confirm that buried wastes have not moved downward in significant quantities toward

X.18 COMMENT LETTER (Continued)

Response (Continued)

the aquifer. Although the buried wastes present no immediate threat, a study is currently underway to evaluate possible alternatives for future disposition of buried transuranic wastes. This study is identified in the Foreword of the final statement.

A separate study (to be completed in 1977) is being made and alternatives assessed, relative to disposition of calcined high-level wastes currently stored in underground concrete vaults at ICPP. As a result of both of these studies a sound basis will be available upon which plans for disposition of these two kinds of waste can be made. One of the possible alternatives, of course, is removal of waste to other sites or to a federal final repository, for disposal in a geologically safe formation.

X.18.19 Comment

"Unavoidable Adverse Effects

This section in the draft statement relates that the adverse environmental effects of routine operations are primarily due to the atmospheric release from the various facilities. The draft statement indicates that the calculated exposure to a person at the INEL boundary is 1.3 mrem compared with 150 mrem from existing natural background radiation. However, this section does not delineate specifically what cumulative impacts may result from the total of all atmospheric releases added to the natural background. We suggest that ERDA's best judgment of the specific impacts of the waste management operations on the human environment should be discussed in the final statement and only those impacts that appear to be in the category of significant adverse effects should be included in this section of the final statement."

Response

The 1.3 mrem exposure is presented because this exposure has a high probability of occurrence and represents a potential 2.0 man-rem general population exposure. The exposure to man from consuming crops or animals that have been grown or grazed near INEL are presented in Section III, but these doses would affect, if any, only a few individuals. Table I-2 (Summary Section) is added which summarizes these potential exposures.

X.18.20 Comment

"Pages I-9 and II-3. Sagegrouse are residents on the INEL and often move long distances from winter to summer habitat, particularly in the project region. As a result, we believe that their entire range should be identified and discussed in the final statement. In addition, we recommend that an estimation of the number of discrete populations involved should be supplied in the final statement."

Response

Data on sagegrouse at INEL are somewhat sketchy and it is not possible at this time to include the information requested. However, in June 1977 a project on sagegrouse migration patterns, as well as mapping of winter and summer ranges, will begin on the INEL site. A population estimate (large numbers are observed on the INEL site in summer and winter) will also be made.

X.18.21 Comment

"Page II-313. The draft statement relates that raptors are indigenous to the area and that some migrant species, including hawks and golden and bald eagles pass through the area. We believe that it is likely that very few raptors could be considered indigenous. The text

X.18 COMMENT LETTER (Continued)

X.18.21 Comment (Continued)

also indicates that golden and bald eagles and the prairie falcon are endangered species. We suggest this statement be corrected in the final statement, since only the Southern bald eagle, ranging south of the 40th parallel is currently officially listed as endangered by the Department of the Interior."

Response

It is true that very few raptors are indigenous to the INEL site. However, many raptors do nest or winter on or near INEL (T. H. Craig and C. H. Trost. 1976, "A Study of the Raptorial Species on the INEL Site," IDO-12080). The golden eagle, bald eagle, and prairie falcon are not endangered species as identified in the statement and are deleted as such. However, one peregrine falcon, which is an endangered species, was seen on the site in 1975. This is identified in the statement.

NOTE

The following comments were received as a supplement to an earlier letter from DOI and generally express the view that the draft statement was inadequate in its treatment of certain geologic hazards, particularly volcanism and earthquakes. In responding to these DOI comments, information provided by the Geologic Division of USGS, who also volunteered additional suggestions for improvements in the text of Part II to strengthen it, have been relied upon.

X.18.22 Comment

"The Radioactive Waste Management Complex (RWMC) is located in a volcanictectonic zone that has experienced volcanic eruptions as recently as about 10,000 years ago and earthquakes probably within the last 40,000 years. We believe that these factors pose geologic hazards to the RWMC and other INEL facilities.

Although it is impossible for us to assess accurately the probabilities for volcanic and earthquake hazards with the data now available, we feel that volcanic eruptions and earthquakes may be expected within the next several tens of thousands of years. These rough estimates of the recurrence intervals for these geologic hazards suggest that INEL is not suitable for the permanent storage of radioactive wastes. Our main concern is that the probability of geologic hazards affecting even the temporary waste storage facilities at INEL is inadequately assessed in the draft statement."

Response

Although the probabilities of recurrence of volcanism and earthquakes cannot be accurately assessed, the existence of these two potential hazards to the safety of waste management operations will be factored into the two current studies (referred to in previous responses) relating to disposition of the calcined high-level wastes now stored at ICPP and the transuranic wastes stored at RWMC. For the long-term (thousands of years), disposition of the latter type wastes must take into account the fact that renewed volcanic activity can, with high probability, impact on the safety of the management methods used (long after the currently stored high-level wastes have decayed to significant levels).

ERDA is fully aware of the hazards called to attention in this comment and concurs with the suggestion that INEL may not be a suitable location for permanent disposal of large quantities of transuranic wastes.

X.18 COMMENT LETTER (Continued)

Response (Continued)

With respect to short-term storage of long-lived wastes the risk of renewal of volcanic activity and attendant earthquakes appears acceptable. The probability of renewal of volcanism within the next 25 years is about 25/10,000, based on an estimate^[a] of approximately 1 in 10,000 per year. As the comment states, data are not available to accurately estimate these very low probabilities. However, it appears that there is adequate time for planning and reassessing plans for the disposition of wastes now stored at INEL. Little more can be said without entering the realm of high speculation. The text of Section II.C.6 discussing this has been supplemented to call attention to the long-term problems of renewed volcanism activity and related earthquakes.

X.18.23 Comment

"The following factors, having important consequences to the evaluation of hazards, are treated inadequately or not mentioned in the statement: (1) the mode of eruption of basalt (rift controlled eruptions); (2) structures of the basalt flow; (3) physical properties of flowing basalt lava (e.g., viscosity, temperature); (4) the areal extent of flows from individual volcanic vents; (5) the ages of basalt flows within the INEL site; (6) the age and significance of rhyolite lava flows and welded tuffs on the margins of the Snake River Plain near INEL; and (7) the age and significance of two rhyolite domes (East Butte and Big Southern Butte) either on or within three miles of the INEL site."

Response

The mode of eruption of the past basalt flows can generally be described as "gentle" in contrast to the "explosive" eruptions sometimes occurring in other volcanic regions.

The basalt formed chiefly from fluid (low viscosity - approximately 1 poise), high temperature (900°C-1200°C), pahoehoe type lavas. The flows were extruded from rifts and from volcanoes whose locations were rift controlled. The areal extent of individual flows varies considerably and since once exposed beds have partially been covered in some areas by wind and water deposited sediments, there are uncertainties about the extent of individual flows. However, estimates as high as 100 square miles have been made. The average is somewhere between 24 and 40 square miles.

The ages of all basalt flows within INEL have not been measured but those that have been vary between ~10,000 and ~1,000,000 years. Most are between 100,000 and 500,000 years old.

The ages of rhyolitic volcanic rocks along the north and south margins of the Snake River Plain are about 4 to 10 million years. These rocks are presumed to underlie the basalt beneath INEL.

The rhyolite domes mentioned in the comment are approximately 500,000 ± 200,000 years and predate the present surface basalt flows on the INEL plain. The above information has been added to Section II.C.7.

X.18.24 Comment

"Conclusions reached in the draft statement are: (1) volcanism can be expected to occur on the Snake River Plain; but no fissures or rifts would be expected in the RWMC; (2) a more likely event would be a lava flow that would cover all or part of the RWMC; and (3) a lava flow could well result in a surface seal to the RWMC contents and would result in an improved condition.

[a] Private communication, M. A. Kuntz, USGS.

X.18 COMMENT LETTER (Continued)

X.18.24 Comment (Continued)

Our field investigations in the RWMC and adjacent areas show that a graben-rift zone (Arco zone) extends from Arco, Idaho, southeastward about 35 miles to about 8 miles southeast of Big Southern Butte. The distribution of volcanic vents associated with the Arco zone suggests that it may be as wide as 15 miles. The RWMC lies within the Arco zone, on its northeast margin. Preliminary ^{14}C (radiocarbon) ages on organic matter from beneath lavas from two rift controlled vents in the Arco zone are as follows:

Cerro Grande lava field	10,500 ^{14}C yr
North Robbers lava field	12,000 ^{14}C yr

Vents for these flows are approximately 13 and 9 miles from the RWMC respectively. We cannot give probabilities for the likelihood of future development of rifts or volcanic vents in the Arco zone or, more specifically in the RWMC, on the basis of data available at present, but our studies and the preliminary age data suggest that the Arco zone has been the locus of considerable structural deformation and eruptive activity from several hundred thousand years ago up to the recent past. Thus, it appears that volcanic hazards do indeed pose a threat to RWMC.

The RWMC is underlain by two lava flows which were erupted from separate sources, both of which are rift controlled vents in the Arco zone. The older flow (estimated age $200,000 \pm 100,000$ yr) is from a vent located about 3 miles south of the RWMC. This flow covered the southern half of the RWMC and flowed at least 12 miles to and beyond the Central Facilities Area of INEL. The younger flow (estimated age $40,000 \pm 20,000$ yr), covering the northern half of the RWMC, emanated from Quaking Aspen Butte, located about 12 miles southwest of the RWMC. The location of these two vents and the extent of their flows suggest that the RWMC may be subject to inundation from future lava flows from both distant and nearby source vents. This problem is compounded by the fact that RWMC lies in a topographic depression into which lava flows, originating to the south, west, and northwest, are likely to be channeled.

Our studies suggest that a small but significant number of basalt eruptions in and near INEL in the past have been of the phreatomagmatic variety. These are moderately violent eruptions which occur when basalt magma comes in contact with large volumes of groundwater such as that which exists in the Snake River Plain aquifer. This type of explosive eruption, along with the more normal fissure and shield eruptions, should they occur in or very near the RWMC, would indeed pose a serious threat to the security of the radioactive wastes stored on pads on the ground surface as well as buried wastes. Rupture of containers and dispersal of radioactive contents are real dangers from eruptions within or near the RWMC.

The great fluidity, large volume, and high lava temperatures of basalt eruptions, similar to those that have occurred in the past on the Snake River Plain, also pose threats to stored radioactive wastes. Rapidly moving fluid basalt lavas could be funneled into the RWMC, disrupt or destroy uncovered containers, and disperse and, possibly, burn or volatilize their contents. Such a process would surely pose a serious threat to the RWMC and would likely not result in an improved condition, as mentioned in the statement.

Studies by USGS geologists in the Yellowstone-Island Park and eastern Snake River Plain areas have shown that explosive rhyolitic eruptions have occurred within and on the margins of the Snake River Plain at least several times within the last few million years. Such eruptions in the future would pose a significant volcanic hazard to RWMC and all of INEL in the form of ash flow deposits and/or air-fall ash deposits. While the likelihood of such an eruption occurring in or near INEL in the immediate future is very small, this factor cannot be overlooked. There is no mention of this type of eruption or its consequences in the statement.

X.18 COMMENT LETTER (Continued)

X.18.24 Comment (Continued)

Our studies suggest that the rocks of East Butte and Big Southern Butte were emplaced by the slow rise of viscous rhyolite magma to form domes. Ages for these two features are about 1 million and 300,000 years respectively. Geological evidence suggests that these two eruptions were quite passive, rather than violent, but the fact that any rhyolite eruption can be potentially violent should not be overlooked. Big Southern Butte is located in the center of the Arco zone, suggesting that the zone's structural weaknesses provided crustal access to rhyolitic as well as basalt magmas. This factor adds another dimension to the potential volcanic hazard for the RWMC and INEL.

In the draft statement, earthquake hazards were also treated inadequately. Lava flows in the Arco zone, which we estimate to be approximately 40,000 years old, are cut by faults with as much as eight meters of displacement.

The area of faulting lies approximately eight miles northwest of the RWMC. There can be little doubt that this faulting was accompanied by earthquakes. This suggests that the RWMC and some reactor facilities at INEL may be subject to earthquakes from sources closer to the RWMC than have heretofore been recognized. This factor is in contradiction to the comment in the statement that 'faulting or earthquakes would not be expected in the Plain itself' (p. III-135). The integrity of unburied waste containers would be seriously jeopardized as a result of local earthquakes. The possibility of an earthquake originating on the plain also poses questions about the integrity of reactor facilities sited elsewhere at INEL. Furthermore, the effects of ground motion at RWMC from earthquakes originating off the plain are dismissed as inconsequential in the statement: 'The safety of materials at the RWMC would not be expected to be threatened' (p. III-135). However, no data are presented to support that conclusion."

Response

Text changes have been made in Section II.C.7 to elaborate on the information called to attention by this comment. Appropriate statements are also included relative to the potential volcanic (and associated earthquake) threats to the safety of stored wastes at RWMC. It should be noted that the probability of renewal of rhyolitic flows (caldera related) is much less than the probability of flows (basalts) from rift areas.

In recognition of the possibility of recurrence of rift controlled eruptions at or near INEL, ERDA is supporting a continuing program, conducted by geologists from USGS, to investigate these questions. These studies are still in progress but sufficient data have been obtained to support the following views.

1. Based on data available December 1976, RWMC lies within a young volcanic-tectonic feature, the Arco Rift Zone. The recurrence interval of volcanic eruptions, faulting, and possibly earthquakes in the Arco Rift Zone, is estimated at approximately 10,000 years.
2. Even though the Snake River Plain appears to be aseismic on the basis of historical earthquake records, the presence of rifts, extensional fractures, and probable fault scarps in the Arco Rift Zone and the fact that earthquakes generally accompany present day volcanism in other parts of the world, suggest that earthquakes have occurred in and near the RWMC in the past. Data are too inadequate to estimate their past frequencies or magnitudes.

In the final statement, assessments of damages to stored wastes have been restated to include the enhanced earthquake potential called to attention in this comment. The statement in

X.18 COMMENT LETTER (Continued)

Response (Continued)

the draft that "faulting or earthquakes would not be expected on the plain itself" is eliminated in the final statement. The statement that "The safety of materials at RWMC would not be expected to be threatened" (by off-plain earthquakes) has been retained. The basis for the statement is two-fold: (a) offsite earthquakes are expected to be well decoupled from the RWMC and (b) the containers for buried wastes or waste stored at the surface would be expected to remain relatively intact from an offsite earthquake, or even from any but the most violent onsite earthquake.

X.19 COMMENT LETTER, Mrs. Susan Carter, Box 192, Menan, ID 83434

Comment

"I am concerned with the genetic defects caused by radiation . . . Will we create a generation of genetically doomed children?"

Response

To put the problem in perspective, the quantities of radiation which all members of the public experience from natural phenomena should be compared with radiation received from ERDA operations, especially its waste management operations. In Idaho, citizens receive considerable radiation from natural sources such as cosmic rays coming down from outer space, from naturally occurring radioactivity in all soils and rocks (from small amounts of uranium and radium always present) and even from the potassium in the body (potassium is an essential mineral, but is slightly radioactive). From these natural sources, an annual quantity of radiation experienced by the ordinary citizen is about 175 units of radiation (the unit is called a millirem). If a person were to take a transcontinental air flight he would receive 1 to 2 additional millirems of radiation. Further, the average citizen experiences about 70 additional millirems of radiation per year from diagnostic X rays. Despite all of this radiation, which everyone experiences, observable genetic defects are very, very rare occurrences. To make the comparison - a person residing 24 hours per day, 365 days per year at the boundary of INEL would receive only and additional 1.3 mrem of radiation from INEL activities. This is only a small percentage of the radiation he receives from other sources, which themselves are generally accepted as genetically safe.

ERDA also is deeply concerned with possible genetic effects (as well as other effects) caused by radiation. As a result of that concern, great precautions are taken not only to protect, from radiation, all personnel directly involved with work at all ERDA sites such as INEL, but also to protect the general public living beyond the ERDA facilities. Genetic effects of radiation are somewhat difficult to evaluate and, even with larger doses of radiation, may not show up until several generations after the radiation is received. Further, if in some distant future (or even second) generation of children a genetic defect is observed, it will be nearly impossible to truthfully ascribe such a defect to radiation, since many other factors also may cause genetic defects (e.g., trace amounts of chemicals, pesticides and other pollutants). Nonetheless, ERDA takes careful measures to ensure that radiation (and radioactive materials) emanating from ERDA facilities are kept at conservatively safe levels.

X.20 COMMENT LETTER, Energy Research Group, Inc., 1661 Worcester Rd,
Framingham, MA 01701

X.20.1 Comment

"Our review of the DEIS on Waste Management Operations at INEL has led to the conclusion that the standards and criteria that apply to the performance of nuclear waste handling and

X.20 COMMENT LETTER (Continued)

X.20.1 Comment (Continued)

treatment programs, and to the assessment of program impacts and alternatives, for federal government wastes appear to be different than those applied to the commercial applications of nuclear materials, particularly commercial nuclear power. The document seems to indicate the acceptability of waste effluents and waste handling and storage operations that are in question as applied to commercial facilities. The scope of analysis, and the assessment of future activities and reasonable alternatives, are insufficient to reach conclusions on the acceptability of the current Waste Management Operations program.

Response

It is not surprising that there are some differences in those regulations applying to commercial nuclear power wastes and those relating to ERDA waste. The commercial facilities are licensed by and operate under the regulations of the Nuclear Regulatory Commission (NRC). ERDA operations are not licensed by NRC and do not precisely follow all NRC regulations, although in most instances they are fully consistent with the intent of the NRC regulations, recognizing differences in the operation and control available. ERDA criteria, standards, and requirements for waste management are spelled out in various ERDA Manual chapters and are constantly being strengthened and 'tightened up' in concordance with an increasing emphasis on environmental protection. These ERDA regulations do, however, provide criteria and standards for the safe management of wastes, and all INEL waste management operations are carried out with full intent to comply with those safety standards.

With respect to future activities, it must be remembered that many of the INEL wastes derive from research and development programs and it is not possible to anticipate what turns those programs may take after several years. However, for the near future, the amount of these wastes is described in the Summary of the statement. It can be stated that whatever direction INEL programs may take, future waste management will be in compliance with regulations applicable at the time.

In addition to onsite generated wastes, INEL also accepts offsite materials and wastes from the military program. No marked changes in the quantities and kinds of waste received from that program are envisaged.

The alternatives section has been rewritten in response to this and other comments.

X.20.2 Comment

'We understand and concur that the scope of the DEIS is not intended to include justification for programs generating nuclear waste, nor to evaluate ultimate waste management/disposal programs; however, there is remaining uncertainty as to the scope and purpose of the DEIS. The DEIS should specifically state the scope of the agency program that is subject to this review, the program assessment that the DEIS is intended to accomplish, and the conclusions of the assessment; that is, whether current program operations are adequate or should be revised.'

Response

The broad scope and purpose of the statement are presented in the Foreword. As stated, the current INEL waste management operations program minimizes, to the extent practicable, environmental impact; however, the statement does identify environmental consequences that have not been fully evaluated. Details of the program are provided in the several major chapters of the statement. Potential revisions of waste management programs at INEL are discussed in the chapter on alternatives which has been rewritten in its entirety. See also the first comment (and response) in X.0.23.

X.20 COMMENT LETTER (Continued)

X.20.3 Comment

"Our principal comments with respect to the DEIS are:

There is insufficient definition of INEL waste management program status and commitments, including committed and projected low-level waste disposal, fuel reprocessing and high-level waste generation and solidification."

Response

The statement provides only a detailed summation of past waste management programs and current programs. With respect to future commitments it is not possible to project those beyond several years, since most of the waste generated at INEL derives from research and development programs. Such programs are often completed and may be replaced by others, the nature and scope of which are not possible to foresee at this time. However, waste projections for the near future are included in the Foreword to the statement. With respect to military wastes handled at INEL, no marked changes in composition or volume are foreseen at the present time. It is highly probable that some wastes currently stored at INEL will be later transferred to the federal repository (now under development) for final disposition. However, at the present time, no firm schedule for such a transfer can be stated, except that it will be beyond 1980.

X.20.4 Comment

"There is insufficient evaluation of alternatives to current and projected program operations."

Response

In response to this and other comments, the entire chapter on alternatives has been rewritten.

X.20.5 Comment

"There is insufficient definition of standards and criteria for waste characterization, waste handling, and implementation of system improvements."

Response

The INEL waste management standards and criteria are summarized in Section II of the statement. Definitions are included in the glossary.

Waste handling is carried out in accordance with policies, procedures, and standards found in various ERDA Manual chapters dealing with personnel protection, protection of the environment, and other considerations. Working personnel protection although important, is not considered an appropriate subject for discussion in the statement. In all cases waste handling is carried out in such a way that releases of hazardous materials are below releases permitted under ERDA regulations (e.g., ERDA Manual Chapter 0524) and in a way consistent with the protection of working personnel.

System improvements are made on the basis of two main considerations:

- (1) The "as-low-as-practicable" philosophy
- (2) A necessity for meeting new or tighter standards.

At INEL, two major improvements in waste management facilities have recently been instituted. At ICPP the Atmosphere Protection System has been installed to permit complete filtration,

X.20 COMMENT LETTER (Continued)

Response (Continued)

through HEPA filters, of all airborne plant effluents. At TRA, construction is underway on the liquid waste purification and recycle system which will ultimately recycle all slightly contaminated waste water now disposed of via seepage ponds. Other less extensive improvements are currently being made at other facilities. These improvements are summarized in Appendix E.

X.20.6 Comment

"The report does not provide sufficient data and projected program requirements to evaluate environmental costs and to evaluate alternative systems or programs which could mitigate future impacts. This information must be known by INEL personnel with a considerable degree of certainty well into the future. Such information should include current onsite spent fuel inventory and processing schedules, and anticipated spent fuel generation and acquisition."

Response

The evaluation of the overall costs of environmental impact is difficult, since offsite impacts are so minimal. Onsite environmental costs have been presented, not in terms of dollars, but largely in terms of land areas committed. Additional costs in the way of any possible long-term vegetative changes cannot be evaluated since changes have not been (and probably cannot be) measured. Likewise, any costs of damage to water resources are too small to be assessed. The same applies to air pollution. Mitigation of future impacts is expected to be largely the basis of meeting "tighter" standards rather than on the basis of environmental cost savings. As noted in a preceding comment, the changing character of research and development work does not permit foreseeing future programs beyond several years.

With respect to fuel inventories and processing schedules, it should be pointed out that a sizeable portion of fuel processed at INEL is from the naval propulsion programs and the information is classified.

X.20.7 Comment

"The DEIS should identify the sources of waste to INEL. For wastes generated offsite, the source of waste to INEL WMO includes external actions such as the transportation of wastes and spent fuels to the site. Since wastes are generated all over the world, the analysis should include transportation costs and risks, and the reasonable alternative of providing waste disposal, reprocessing, and treatment (the NWCF) where the wastes are generated. Consideration should also be made of the fact that recovered uranium is transported back to Oak Ridge or Portsmouth. Projections of waste and spent fuel transportation, and the shipment of recovered products, should be included."

Response

See response to Comment X.17.1.

X.20.8 Comment

"The alternatives that are presented are generally trivial and are discussed without analysis, evaluation, conclusions or recommendations. Reasonable alternatives should be realistically assessed, rather than the presentation of unrealistic alternatives refuted by superficial arguments. Among the reasonable alternatives that should be evaluated are: suspension of waste operations pending establishment of uniform standards for military, research and commercial waste programs; meeting NRC regulatory standards; ceasing all discharge to seepage basins, with and without recovery of radioactivity in soil columns; and ceasing the calcination of wastes pending development of a vitrification process, or replacing the NWCF with a developmental vitrification facility, including an evaluation of the advantages of a vitrified product over a calcined product.

X.20 COMMENT LETTER (Continued)

X.20.8 Comment (Continued)

Radioactive waste and effluent treatment systems, flow sheets and component descriptions, and the evaluation of alternative designs should be presented. System flow data on waste and effluent streams as to volumes, waste characteristics, activity levels and radionuclide content should be included.

Differences in fuel reprocessing, storage, handling and release criteria should be explicitly identified. The position of the federal government on reprocessing of spent nuclear fuels should be addressed in the light of ICPP operations. If the federal government recommends against commercial reprocessing 'at the present time pending resolution of the issues,' the rationale for continued operation of ICPP and the construction of the NWCF should be presented."

Response

In response to this and other comments, the chapter on alternatives has been expanded and completely rewritten, although parts of the detail requested in this comment cannot be supplied without prohibitively extensive engineering studies.

With respect to any possible "federal government" recommendations against commercial fuel reprocessing, it must be pointed out that all of the ICPP reprocessing is not for commercial fuel, but rather for ERDA fuel or military fuel, often of high enrichment and therefore of much greater value.

X.20.9 Comment

"There is no reasonably quantitative assessment of accident risks. No data on inventories and release potential for severe abnormal conditions are presented. Particular attention should be given to the ICPP, the TSA, and the NRF Expanded Core Facility."

Response

The statement discusses INEL waste management programs, and nonwaste facility processes are outside the scope of the document. However, Safety Analysis Reports (Safety Review Documents) are currently being written for ICPP and RWMC (which includes TSA). These will address inventories of radionuclides and release potentials under various predicated accident conditions. The comparable evaluation for NRF-ECF is a classified document. The ICPP and RWMC reports have not yet been issued. However, some accident scenarios for these facilities are presented in Section III.C.

X.20.10 Comment

"We are of the belief that the potential hazards and environmental impacts of nuclear wastes, subject to a reasonable and responsible waste management program, are well within the category of acceptable risks to public health and safety and to the environment. We are concerned that the present document does not adequately describe the wastes and the waste handling process in the INEL Waste Management Operations program. Explicit descriptions of waste sources, waste characterization, waste treatment and impact assessment, including a more comprehensive analysis of alternatives, and identification of program and systems modification, where justified, will meet the intent of NEPA and demonstrate the minimal impact and acceptable risks associated with the generation and handling of nuclear wastes."

Response

Waste and waste handling descriptions are found for each facility at INEL in Part II of the statement. Each facility produces somewhat different "mixes" of waste, and waste treatment

X.20 COMMENT LETTER (Continued)

Response (Continued)

and handling at each facility are somewhat different than at every other one. For this reason, wastes and waste handling are described individually for each facility and have not been treated all together, except where there is a common impact. With respect to analyses of alternatives, a completely rewritten chapter on alternatives has been added to the statement.

X.21 EXHIBITS

In this section, reproduced in full as Exhibits 1 through 20, are letters received commenting on the draft statement. The report of the hearing board is reproduced as Exhibit 21.